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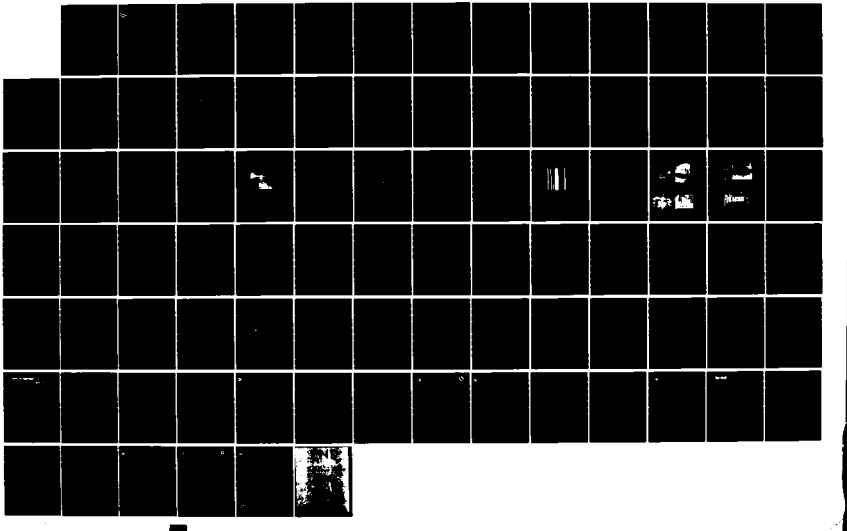

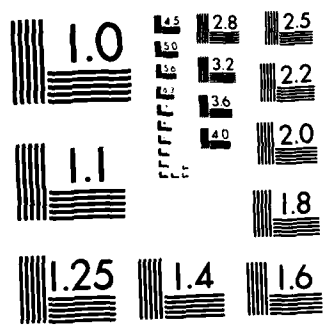

Wisconsin River at Portage, Wisconsin

Feasibility Study For Flood Control

Plan of Study

US Army Engineer District, St. Paul, Minnesota

August 1977

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The potential exists for a disastrous flood at Portage, Wisconsin, due to the topography of the area and previous attempts to modify the flood flow characteristics of the Wisconsin River. Levees built by local interests do not meet design standards of the Corps of Engineers or Wisconsin Dept of Natural Resources. This plan of study provides a framework for development of alternative flood control plans. Major items included are: a general profile of the study area, identification of flooding and related problems and

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possible alternatives to solve these problems, an outline and general description of the investigations to be conducted during the study, and a description of the public involvement program.

WISCONSIN RIVER AT PORTAGE, WISCONSIN

FEASIBILITY STUDY FOR FLOOD CONTROL

PLAN OF STUDY

This study plan is an initial analysis of the flood problems at Portage, Wisconsin, and outlines alternative solutions for further consideration. It is the first of three stages of the feasibility investigation and is based on data currently available. Changes in the study plan may be expected as more information becomes available.

St. Paul District, Corps of Engineers
St. Paul, Minnesota 55101

August 1977

WISCONSIN RIVER AT PORTAGE, WISCONSIN
FEASIBILITY STUDY FOR FLOOD CONTROL
PLAN OF STUDY

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WISCONSIN RIVER AT PORTAGE, WISCONSIN
FEASIBILITY STUDY FOR FLOOD CONTROL
PLAN OF STUDY

INTRODUCTION

The potential exists for a disastrous flood at Portage, Wisconsin, due to the topography of the area and previous attempts to modify the flood flow characteristics of the Wisconsin River. Local interests have built levees in an attempt to prevent frequent overflow in the Portage vicinity; however, the levees do not meet design standards of the Corps of Engineers or the Wisconsin Department of Natural Resources. In response to local requests, a study was authorized by Congress to investigate alternative plans for flood protection in the Portage area.

This plan of study provides a framework for development of alternative flood control plans. Major items included in the plan of study are:

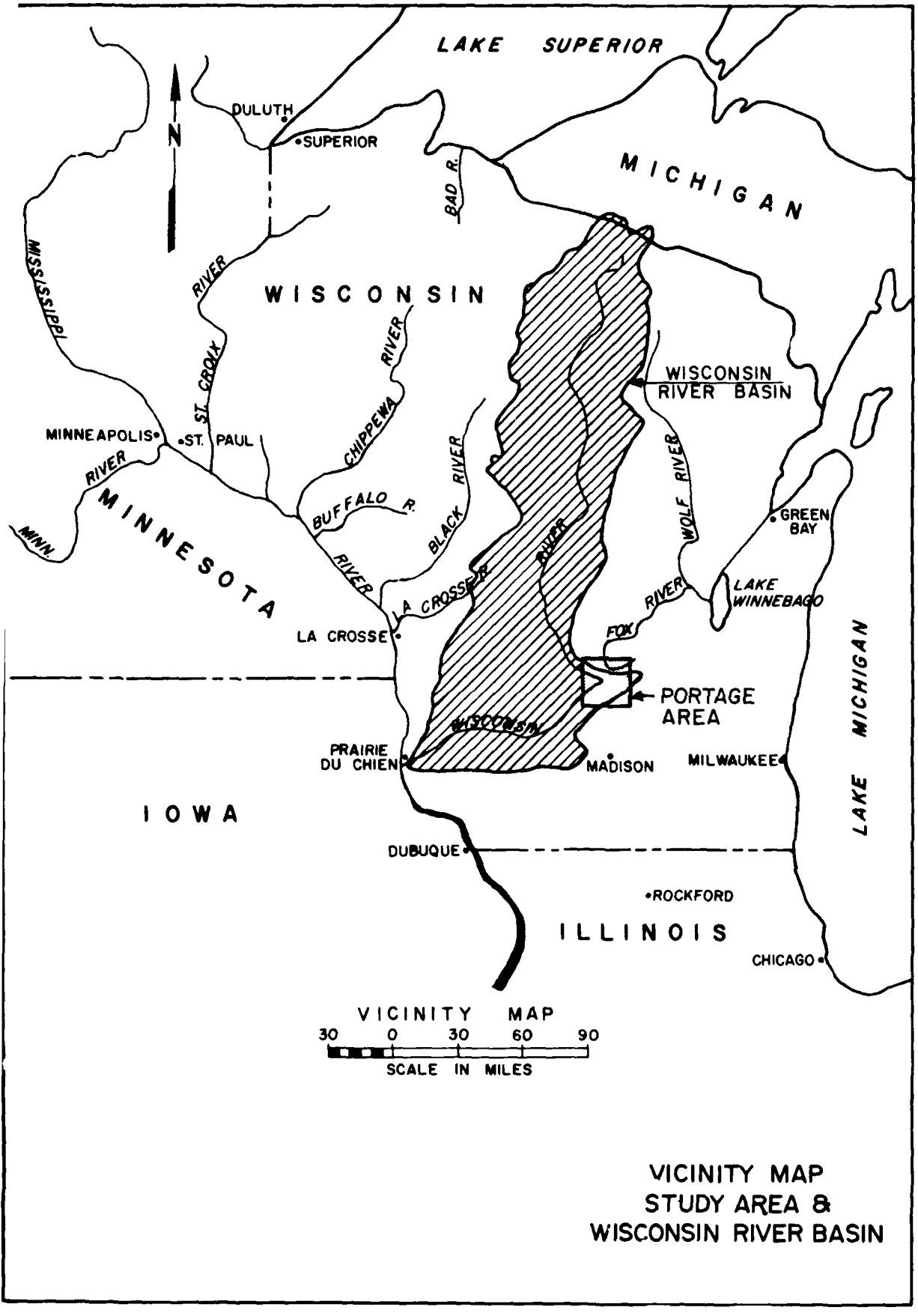
a. A general profile of the study area.

b. Identification of flooding and related problems and possible alternatives to solve these problems.

c. An outline and general description of the investigations to be conducted during the study.

d. A description of the public involvement program.

The plan of study is intended to be used as a guide by all participating Federal, State, and local concerns. The following map shows the study area.



VICINITY MAP
STUDY AREA &
WISCONSIN RIVER BASIN

LEGISLATIVE BACKGROUND

At the request of the Wisconsin Department of Natural Resources, a reconnaissance was conducted to determine the feasibility of local flood control improvements on the Wisconsin River in the vicinity of Portage. The reconnaissance report, completed in November 1971, was prepared under authority of section 205 of the 1948 Flood Control Act, as amended, and indicated that a local flood protection project was feasible at a cost of about $2.2 million. Because Federal costs were limited at that time to $1 million under the section 205 authority and to avoid substantial non-Federal costs, further study under the survey investigation program (feasibility study) was recommended.

Authority for the present study was provided by a congressional resolution sponsored by Representative Robert Kastenmeier and adopted by the House Committee on Public Works, 14 June 1972. The resolution reads as follows:

> "Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports on the Wisconsin River and tributaries, submitted in House Document No. 259, 71st Congress, 2nd session, with a view to determining whether the recommendations contained therein should be modified in any way at this time, with particular reference to improvements for flood control and allied purposes at Portage, Wisconsin."

Study funds were received in October 1976. Although prior studies of the Wisconsin River basin have been conducted, this study is the first comprehensive investigation of alternative flood control plans for the Portage area.

SCOPE OF THE STUDY

This study will develop effective and acceptable alternative flood control plans for the Portage area. The general study area includes Portage and the adjacent townships of Lewiston, Caledonia, Pacific, and Fort Winnebago in Columbia County and the township of Fairfield in Sauk County, Wisconsin. The upper Fox River basin will also be studied in regard to Wisconsin River overflows and potential flood damages. The study area is not limited by these boundaries, however, and will be extended as far as significant impacts or enhancement opportunities occur and will be more precisely defined during the study.

In cooperation with participating agencies and concerned citizens, flood problems will be identified and alternative solutions developed. The alternative plans will be compared and refined based on technical feasibility; environmental, social, and economic impacts; institutional arrangements (implementation and management); and public acceptability.

The study will be conducted in three stages. Stage I incorporates into a plan of study an outline of how the study will be conducted, identification of flooding and related problems, and general discussion of flood control alternatives. Stage II will concentrate on data collection, identification of specific problems and problem areas, preliminary formulation of all possible alternatives, and broad impact assessment and evaluation. At the end of Stage II only a few of the most feasible solutions will have successfully passed the screening process. The data and results of Stage II will be presented in an interim report to be distributed for review and comments. Stage III will further refine the screened alternatives and assess and evaluate impacts in greater detail. The final plans in Stage III will include a survey scope level of detail, providing adequate evaluation detail for a clear choice among alternatives but not supplying sufficient design detail for use in construction plans.

The products of the study will be a main report, technical appendix, and environmental impact statement. The main report will describe the study, document major decisions, and discuss results and recommendations. The technical appendix will provide specific details of the engineering and economic analyses. The environmental impact statement will document and describe all significant effects associated with each alternative and discuss possible measures to mitigate or enhance these impacts. A draft of the report will be distributed for public review and comment.

The final report will be submitted to Congress. If an acceptable, economically feasible alternative is identified, the plan will be recommended for detailed design and construction authorizatio the final report submitted to Congress.

PRIOR STUDIES

Several reports have been prepared by the Corps of Engineers on flooding problems in the Wisconsin River basin. The results of these earlier studies are described briefly below.

A report on a preliminary examination of the Wisconsin River and tributaries was submitted to Congress on 17 January 1930 and published in House Document No. 259, 71st Congress, 2d session. The report included consideration of navigation, flood control, power, and irrigation needs in the Wisconsin River basin and concluded that improvements on the Wisconsin River lacked economic justification at that time. The Portage levees were mentioned briefly and were considered adequate for flood control.

A preliminary examination report for flood control on the Wisconsin River, prepared 30 March 1944, reevaluated the flood potential of the Wisconsin River basin. Again, the Portage levee system was mentioned

briefly and was considered adequate. Based on the conclusions of the review, a survey of the basin was recommended with a view toward developing a suitable program for flood control. However, organized interest in flood control declined in the following years. Consequently, in response to the request for a review survey of the Wisconsin River basin for flood control, a brief letter report dated 28 January 1955 recommended no further action at that time.

A reconnaissance report, completed November 1971, was conducted under authority of section 205 of the 1948 Flood Control Act, as amended. The reconnaissance determined the feasibility of local flood control improvements on the Wisconsin River in the vicinity of Portage. The report indicated that strengthening, raising, and extending the existing Portage and Lewiston levees appeared to be the most feasible flood control plan (no action was recommended for the existing Caledonia levees). This plan was estimated to have $1.50 in benefits for every $1 in cost. Benefits were based only on the reduction of flood damages to existing developments in the city of Portage. Because construction costs estimated at $2.2 million greatly exceeded the $1 million limitation for Federal expenditures under the small flood control project authority and to avoid a substantial non-Federal cost, the report recommended continuing the study under the survey investigation program.

A report entitled "Flood Plain Information on Wisconsin River in Vicinity of Portage, Wisconsin," was completed in June 1972 and described the characteristics of past floods and estimated the extent of probable future floods, although development of alternative flood control plans was not within the scope of this study. The report was intended to guide the planning and development of flood-plain regulations. However, in view of the changed policies, criteria, and economic and physical conditions in the study area, an updated and more detailed hydrology and hydraulic analysis will be developed for the feasibility study.

FLOOD INSURANCE STUDY

The Federal Insurance Administration of the U.S. Department of Housing and Urban Development is conducting a flood insurance study for Portage and Columbia County. The study will divide the Portage area into zones according to potential flooding risk. The results of the study can be used as a guideline to determine insurance rates for properties in the floodplain.

Currently, Columbia County and the city of Portage are participating in the "emergency" flood insurance program. Under this program, federally subsidized flood insurance is available for property in the floodplain. The emergency program is an interim measure, in effect until the more detailed flood insurance study is completed.

INTERAGENCY HYDROLOGY AND HYDRAULIC ANALYSIS OF EXISTING CONDITIONS

The flood insurance study and the Corps feasibility study require a hydrologic and hydraulic analysis of existing conditions to determine the frequency and extent of probable future floods. Accurate and updated flood flow analysis for other communities along the Wisconsin River is needed by Federal, State, and local agencies. The Wisconsin Department of Natural Resources and the U.S. Geological Survey have expressed a need for a low-flow analysis of the Wisconsin River. Because of these common objectives, a hydrology and hydraulic analysis of existing (without project) conditions will be developed jointly by the Department of Natural Resources, U.S. Geological Survey, and the Corps. The Federal Insurance Administration has also been invited to participate. Details on the scope and allocation of work for the analysis are given in the section entitled "Work Items."

PLANNING PROCESS

The planning process for this study will be accomplished in three stages: Stage I, the plan of study; Stage II, concentration on development of alternatives; and Stage III, refinement of detailed plans. Each stage will include at least one sequence of the following tasks:

Task 1. Problem identification.

Task 2. Formulation of alternative plans.

Task 3. Impact assessment.

Task 4. Evaluation.

The tasks will be developed in greater detail with each successive sequence or iteration. The first task, problem identification, involved determination of all flooding and related problems, including the potential for flooding; establishment of the study objectives; and description of the existing and projected economic, social, and environmental characteristics of the study area. The objectives of the study are derived from the problems identified for the area and from State and Federal laws and regulations. In addition, "Principles and Standards for Planning Water and Related Land Resources" requires all federally assisted water resources projects be planned to achieve two national objectives: national economic development (NED) and environmental quality (EQ). The national economic development objective is to develop the most cost effective solution from a national viewpoint; i.e., the plan with the greatest net economic benefits. The environmental quality objective is to maximize environmental benefits and minimize any adverse effects.

The aforementioned objectives will be used as a basis for task 2, formulation of alternatives. The alternatives for each iteration will be developed to a comparable level of detail and only to the degree necessary to allow clear choices among alternatives.

Impact assessment, task 3, will identify and measure the economic, social, and environmental changes associated with each alternative as compared to the base line condition (without project). The level of detail for impact assessment and design will be consistent; e.g., only a generalized assessment will be made for the preliminary alternatives.

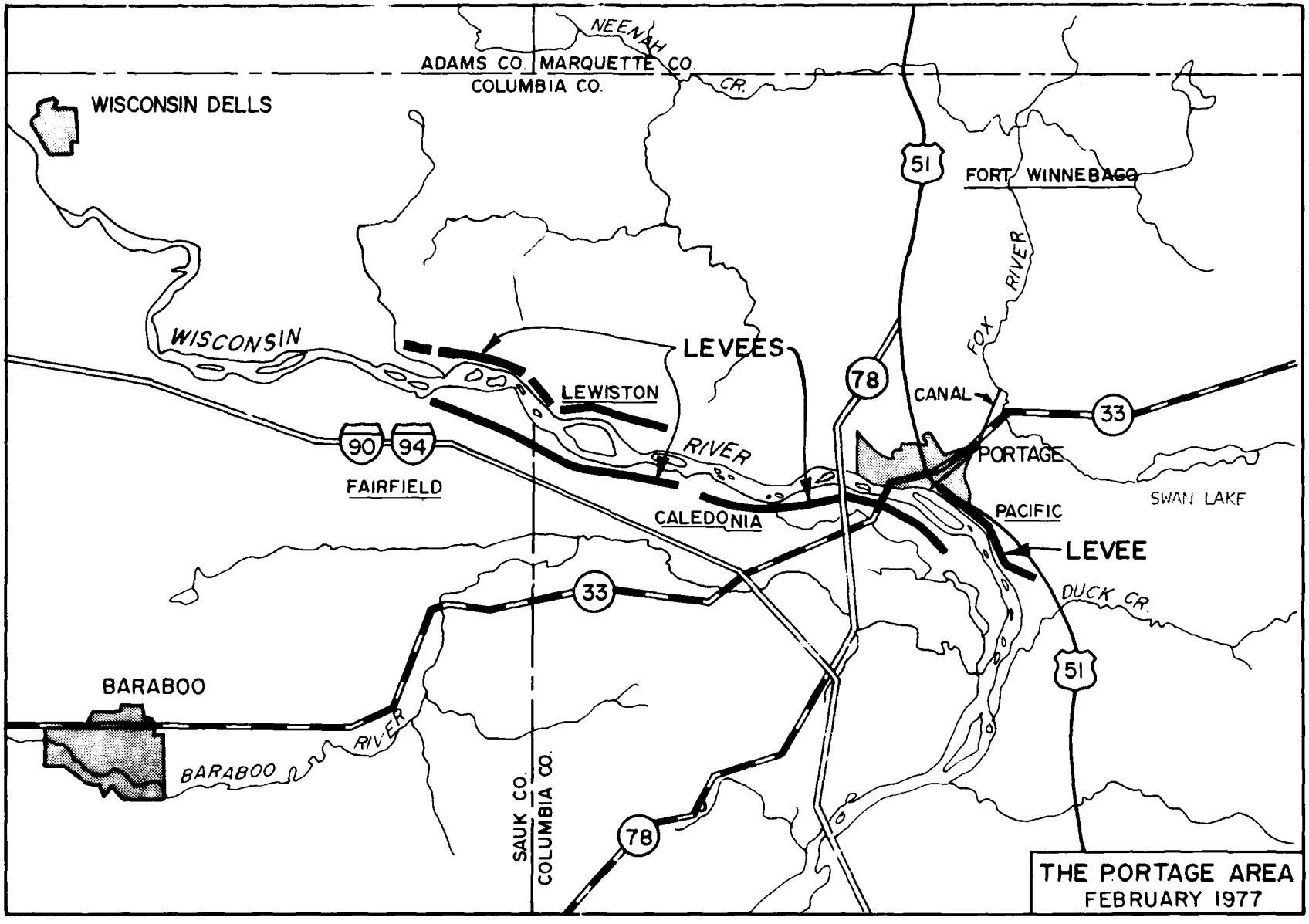
The evaluation task screens the alternatives by comparing beneficial and adverse impacts and determining the extent to which the alternatives achieve the objectives. In evaluating alternatives, trade-offs naturally occur in an effort to maximize the objectives. The trade-off analysis will clearly indicate what is gained or lost by choosing a given alternative over others. Selected alternatives or the best components of alternatives will be carried forward to the next iteration of the four tasks for further refinement. The views of Federal, State, and local agencies and concerned citizens will be solicited throughout the planning process as described in the section on public involvement.

STUDY AREA

GENERAL CHARACTERISTICS

Location

The study area is in south central Wisconsin in Columbia County, about 40 miles north of Madison, Wisconsin. The main study reach is the Wisconsin River floodplain from the Columbia-Sauk County line (river mile 122) near Lewiston, downstream through Portage to the Interstate 90-94 bridge (river mile 106). Also to be studied are portions of Duck Creek and the Baraboo River as affected by Wisconsin River backwater and portions of the Fox River basin as affected by Wisconsin River overflow. Municipalities within the study area include Portage, Lewiston, Caledonia, Pacific, and Fort Winnebago in Columbia County and Fairfield in Sauk County. A map of the Portage area is shown on page 10.


NEENAH CR.
ADAMS CO.
MARQUETTE CO.
COLUMBIA CO.
WISCONSIN DELLS
51
FORT WINNEBAGO
FOX RIVER
WISCONSIN
LEVEES
78
CANAL
33
LEWISTON
90
94
RIVER
PORTAGE
SWAN LAKE
FAIRFIELD
CALEDONIA
PACIFIC
LEVEE
33
DUCK CR.
51
BARABOO
BARABOO RIVER
SAUK CO.
COLUMBIA CO.
78
THE PORTAGE AREA
FEBRUARY 1977

Climate

The climate of the area is classified as continental. Winters are cold and snowy and summers are warm. The mean annual temperature is about 48° F. January is the coldest month, averaging 20° F and July is the warmest, averaging 74° F. Extreme temperatures have ranged from a low of -33° F in January 1930 to a high of 111° F in July 1936. The average annual precipitation is about 30 inches, with about 55 percent of the total precipitation falling from May through September. The average annual snowfall is 41 inches.

Drainage and Topography

The Wisconsin River basin lies in the central portion of Wisconsin except for the northernmost tip which extends into Michigan. The basin has a drainage area of 11,730 square miles of which 7,940 square miles are above Portage.

The Wisconsin River is the State's largest river. From its source in the Lac Vieux Desert in the northern peninsula of Michigan, the river flows generally south. Below Nekoosa, Wisconsin, about 220 miles from its source, the river cuts deeply through soft sandstone, especially in the Wisconsin Dells in northwestern Columbia County. Here the river contracts from 1/3 mile to about 50 feet in width with high sandstone bluffs on both sides. Below this narrow reach the river widens suddenly and deviates to the east until it reaches Portage, about 315 miles from its source. Turning abruptly to the southwest below Portage, the river flows in a flat, wide valley with steep bluffs on both sides. Apparently, quartzite ridges caused the river to flow east until it reached the vicinity of Portage where the sandstone bluffs deflected it westward. About 115 miles below Portage, just south of Prairie du Chien, Wisconsin, the Wisconsin River enters the Mississippi River. The Baraboo River, with a drainage area of 650 square miles, is the only major tributary to the Wisconsin River in the study area.

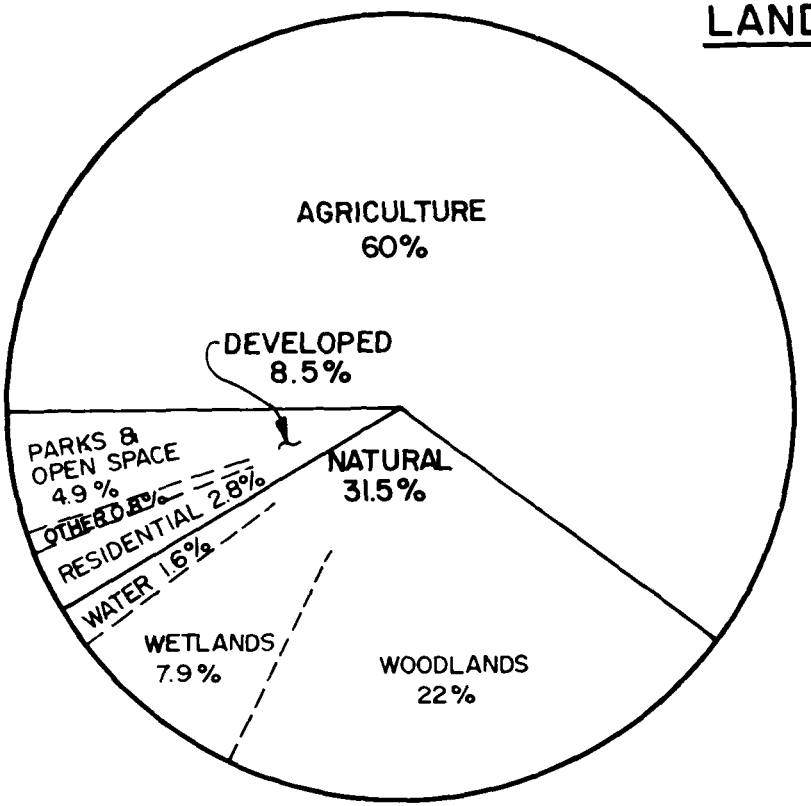
The Fox River rises in northeast Columbia County and flows generally southwest through flat and marshy land to the Portage area. Above Portage, the Fox River has a drainage area of 900 square miles. Downstream, the Fox River flows generally northeast through a series of lakes to Green Bay, Wisconsin, on Lake Michigan, about 165 miles from its source. Near Portage the Fox River is less than 2 miles from the Wisconsin River and about 6 feet lower during normal river stages. A 2 1/4-mile-long canal was formerly used for transportation between the two river systems.

The topography of Columbia County varies from level black prairies to the rugged hills of the Baraboo Range in Caledonia. Elevation ranges from about 780 feet to over 1400 feet above sea level. The north central portion of the county, including most of the study area, is within the central Sand Plain which was formed when glaciers dammed up the Wisconsin River, creating glacial Lake Wisconsin. Upland waters drain into numerous ponded valleys, lake beds, and lakes. From these areas the water is carried by slow streams to the larger rivers such as the Wisconsin, Baraboo, and Fox Rivers.

Land Use

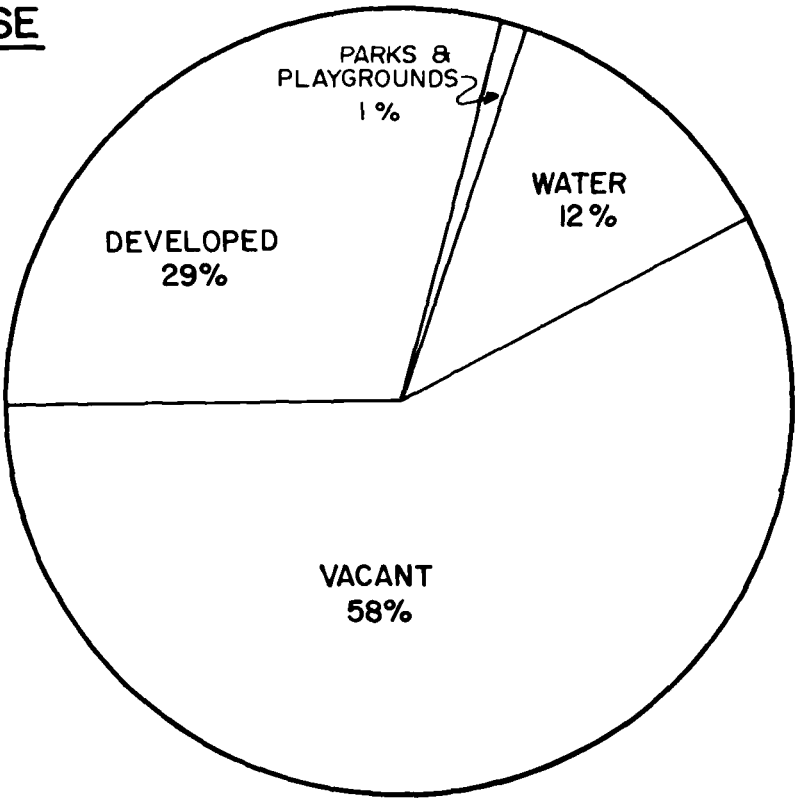
The Columbia County Planning Department has classified various land uses in the county with the three major classifications being agricultural, natural, and developed areas. The following figure shows the land use distributions for the four township areas adjacent to Portage. As indicated in the figure, most of the over 111,000 acres near Portage are used for agriculture, followed by natural areas such as woodlands, marshes, lakes, and streams. Land use within Portage is also shown in the following figure. Slightly more than one-half of a total 4,960 acres is classified as vacant and about one-third as developed.

LAND USE



LEWISTON, CALEDONIA, PACIFIC & FORT WINNEBAGO TOWNSHIPS

SOURCE: EXISTING LAND USE, REPORT NO.2, COLUMBIA COUNTY PLANNING DEPT. 1970



CITY OF PORTAGE

SOURCE: WATER & SEWER PLAN NARRATIVE REPORT, COLUMBIA COUNTY, CANDEUB, FLEISSIG & ASSOCIATES, 1972

WATER AND RELATED LAND RESOURCES

Fish and Wildlife

A variety of game and nongame animals is found in Columbia County. All of the game mammals are permanent residents and include muskrat, beaver, red fox, and otter. Nongame mammals include porcupine, chipmunks, red squirrels, and pocket gophers.

At least 232 species of birds have been recorded in Columbia County. Some of the county's best bird habitat is near Portage. Game birds include pheasant, grouse, quail, and several types of waterfowl and shorebirds. Nongame birds include a variety of water birds, songbirds, and birds of prey. The Pine Island Goose Refuge, one of several State-managed wildlife preserves in the county, is in the study area. The Wisconsin River floodplain immediately west of Portage has been characterized as some of the best floodplain woods along the river. Floodplain woods provide nesting habitat for species such as the red-shouldered hawk (on the Wisconsin Department of Natural Resources "threatened" list), barred owl, and wood duck. Bald eagles make some winter use of the study area. Peregrine falcons nested near Lake Wisconsin in the past and may be reintroduced in the watershed. The Swan Lake section of the Fox River contains an excellent mix of marsh, prairie, woods, and open water which provides excellent habitat for a number of species including marsh hawks (on the Department of Natural Resources "watch" list). The area west of Portage and immediately north of the Wisconsin River contains some of Wisconsin's most productive sandhill crane habitat.

Many of the State's 174 species of fish can be found in Columbia County. A very good sport fishery for a number of game fish, including walleye and muskellunge, exists in and near the study area. Though once an important food source, recreational use has now exceeded the commercial value of the fishery.

Forests

Forests cover about 120,000 acres or 24 percent of Columbia County. Trees include maple, elm, aspen, willow, ash, and oak. Commercial forestry is currently not a large county industry.

Outdoor Recreation

Over 23,000 acres of surface water in Columbia County are heavily used for fishing, boating, and swimming. Six trout streams, totaling 36 miles, and two smallmouth bass streams, totaling 45 miles, are within the county; over 10,000 acres are provided for public hunting and fishing grounds including three Department of Natural Resources public hunting areas in and near the study area. Within Portage are four parks, all adjacent to the Wisconsin River, and several historical sites and trails.

The comprehensive development plan prepared by the Columbia County Planning Department states, however, that the county has many deficiencies in meeting Wisconsin standards for outdoor activities and national guidelines for parks and open space acreage. Since the county is primarily rural, a significant portion of the outdoor recreation demand is nonresident, coming primarily from the Madison area. The Columbia County Outdoor Recreation Plan, prepared by the Department of Natural Resources, states that the county will need additional campgrounds, picnic areas, golf courses, swimming beaches, and canoe routes to meet the expected large increases in outdoor recreation demand.

Navigation

Because Portage is between the Wisconsin and Fox Rivers, it became an important trade and transportation point. The Portage canal was built to facilitate traffic between the two major river systems.

From its final construction by the Corps of Engineers in 1876 to the early 1900's, the canal was used extensively by steamers, smaller craft, and government boats; however, the canal never reached its anticipated peak as a commercial highway. Other methods of transportation, such as the railroad, replaced water travel. The canal was closed for lack of use in 1951 and the Fox River lock was replaced with an earth dike.

No commercial navigation currently exists on the Wisconsin or upper Fox Rivers. Only pleasure boats use the rivers now, particularly in recreation areas such as the Wisconsin Dells.

Water Supply

Municipal, industrial, and rural demands for water in the county are supplied from wells. Municipal wells range in depth from 200 to 600 feet with private wells typically less than 200 feet. In general, water supply for domestic use can be obtained easily and is not a limiting factor in development. Irrigation is not used extensively. Within the study area about 80 acres in Pacific and 80 acres in Caledonia are irrigated with water from wells.

Soils and Minerals

The Water and Sewer Plan for Columbia County (1972) identified soil types according to their suitability for development. Most of the soils in the county originated from the weathering of glacial debris left from the fourth glacial advance. Loamy soils over glacial till and sandy glacial outwash soils occupy large areas throughout the central and northern parts of the county. In general, these soils are well suited for development.

Interspersed within the glacial soil areas are organic (peat and muck) and alluvial soils and an occasional hill with rock outcrops. Though organic soils are found near Lewiston, the most extensive areas of these soils are near Portage along the Wisconsin and Fox Rivers. These soils have severe limitations for residential development because of the high water table, flooding hazard, and low bearing capacity. Alluvial soils along rivers and streams also have severe limitations due to the flooding hazard. Residual soils are not extensive but occasionally occur throughout the county, particularly in Caledonia. The steep slopes and shallow soil depths with bedrock beneath are also severe limitations for development.

Minerals

The minerals currently quarried and processed in Columbia County are sand, gravel, and limestone. The sand is used extensively for glassmaking, molding, and other interests. Potential uses exist for the Baraboo quartzite but, as of now, none is quarried within the county.

SOCIAL-ECONOMIC PROFILE

Population

From 1940 to 1970 the study area and the county had slow but steady increases in population. The State of Wisconsin and the United States had significantly higher growth rates over the same period.

Population projections to 1990 by the Wisconsin Department of Natural Resources show a continued slow increase in study area population. Past and projected population data are shown in the following table.

Study area population, past and projected

Town or city	1940	1950	1960	1970	1980	1990
Caledonia	928	832	790	855	880	960
Fort Winnebago	535	551	626	673	770	880
Pacific	310	300	531	756	850	970
Portage cluster	7,762	7,997	8,676	8,805	8,660	8,315
Portage	(7,016)	(7,334)	(7,822)	(7,821)	-	-
Lewiston	(746)	(663)	(854)	(984)	-	-
Total study area	9,535	9,680	10,623	11,089	11,160	11,125
Columbia County	31,758	33,640	36,634	40,427	44,700	50,500

Source: Small Area Population Projections for Wisconsin, Technical Bulletin No. 59, Wisconsin Department of Natural Resources, 1972.

Summer residents are not included in the figures above. Growth in summer population is occurring particularly along the Wisconsin River and in lake communities. Excluding the Wisconsin Dells, an estimated 1,645 summer residents inhabited private seasonal houses in the county in 1970 (Water and Sewer Plan, Columbia County, 1972); about 470 resided within the study area, primarily along the Wisconsin River. The number of summer residents within the study area is expected to increase to over 1,200 by 1990.

Industry and Employment

Agriculture is still a major employment source in Columbia County, but it has suffered a large decline in recent years. More than one-half of the 1950 farm labor force was lost by 1970. Even more significant is the change in the economic base as reflected by the proportion of total employment. In 1950, about 32 percent of the labor force was employed in agriculture and by 1970 this figure had dropped to less than 12 percent. The decline in agriculture has been offset due to the increase in manufacturing, services, and trade employment. Data on employment by major industry for Columbia County in 1970 are presented in the following table.

Industry of employed persons, Columbia County, 1970

Industry	Number employed	Percent
Agriculture, forestry and fisheries	1,838	11.8
Mining	57	0.4
Construction	1,061	6.8
Manufacturing	3,807	24.3
Transportation, communication and utilities	868	5.5
Trade	3,237	20.7
Services	4,063	26.0
Public administration	704	4.5
Total employed	15,635	100.0

Source: General Social and Economic Characteristics of Wisconsin, Bureau of the Census, 1972.

Unemployment in the county was 3.6 percent of the labor force in 1970, slightly less than the 4-percent unemployment rate for the State. Median county income was $9,668 in 1970, as compared to $10,068 for the State. The percent of families with less than poverty level income was about the same for both county and State at 7.5 and 7.4 percent, respectively.

Cultural Resources

The Portage area has many places of interest and significance related to the early exploration and settlement of Wisconsin. The Surgeons Headquarters for Fort Winnebago, the Old Indian Agency House, and the Fox-Wisconsin Portage Trail are listed in the National Register of Historic Places. In addition, the Portage canal is currently being considered for the National Register. The Historic Preservation Division of the Wisconsin State Historical Society has undertaken a preliminary architectural survey of Columbia County. Within the study area, 103 structures were identified as being of some architectural-historical significance: 95 structures in Portage, 6 structures in Caledonia, and 1 structure each in Lewiston and Fort Winnebago. There are also 51 reported archeological sites in study area townships: 12 in Caledonia, 10 in Lewiston, 22 in Pacific, and 7 in Fort Winnebago.

Near the study area, two significant natural areas have been indicated by the National Park Service: south of Baraboo the Devils Lake Unit of the Ice Age National Scientific Reserve and Black Hawk Island near Wisconsin Dells, a possible candidate as a National Natural Landmark. Also near the study area is the Leopold Memorial Reserve composed of about 1,200 acres along the Wisconsin River in Fairfield Township in Sauk County and Government Islands 8 and 9 in the Wisconsin River in Columbia County. It was in this natural setting that the late Aldo Leopold, often called the "Father of Wildlife Management," wrote some of his famous works in the still-standing log cabin he built.

Prehistory. - The prehistory of Wisconsin is far from completely known. The Fox-Wisconsin waterway is the most convenient route to the Mississippi River from the Upper Great Lakes, thus a logical area for archeologists to search for information regarding prehistoric habitation and pathways of migration and trade.

The earliest occupants of southern Wisconsin were the nomadic big game hunters, whom archeologists refer to as the Paleo-Indians, about whom very little is known. However, evidence indicates they lived in southern Wisconsin from 1300 to 8500 B.C.

Following the retreat of the glaciers, the Eastern Woodlands of North America were occupied by small and locally diverse communities of people. This period, from about 9000 to 1000 B.C., is referred to as the Archaic cultural tradition. The various adaptations of this period are fairly well known from sites in southwestern Wisconsin, especially along the Wisconsin River. Two Archaic adaptations in the area are identified by the distinctive artifacts found in burial sites. The Old Copper cultural pattern is characterized by tools, weapons, and ornaments fashioned from naturally occurring copper which was mined in northern Wisconsin and adjacent portions of Michigan.

In contrast, the burials associated with the Red Ochre cultural pattern are identified by stone artifacts that were placed in the burial mounds and the mineral red ochre which is found spread over the skeletons. Little detailed information is currently known about the habitation sites of these peoples. It is reasonable to expect them in the same general areas as the burial sites, but they await discovery by systematic archeological surveys.

The next period, the Woodland, is distinguished by the appearance of pottery. Sites were occupied for longer periods of time during the year and by greater numbers of people. The use of plants for food continued to increase, with fish and game animals still major resources. This period lasted from 1000 B.C. until historic contacts with Euro-Americans.

It was during this period that the Hopewell Culture spread north along the Illinois and Upper Mississippi River valleys to southwestern Wisconsin. Numerous burial mounds and village sites indicate their presence. Another distinctive culture known as the Effigy Mound Builders developed and flourished locally in southern and central Wisconsin, southwestern Minnesota, and northeastern Iowa. These effigy mounds differed from the earlier Hopewell mounds in that they were constructed in the form of birds, reptiles, mammals, and human figures.

Another group of people that settled in southern Wisconsin are known as Upper Mississippian. They lived in large villages, growing maize and other crops, supplemented by hunting and fishing. Their sites are numerous, dating from 1000 A.D. until historic contact. The relation between Upper Mississippian and Woodland peoples is not yet known.

History. - The arrival of Nicollet at Green Bay in 1634 marks the beginning of the historic period for central Wisconsin. At that time the Menomini, Winnebago, Sioux, and Miami were peacefully living in Wisconsin. Within the next 20 years the Indian population of Wisconsin drastically changed. The Iroquois Indians, from the eastern Great Lakes, waged war against the Hurons, their major competitors for control of the fur trade. In 1654, the Hurons were nearly exterminated by the Iroquois, who were in possession of a substantial number of guns. The Hurons and several other Indian groups including the Ojibway, Pottowatomi, Kickapoo, Sauk, and Fox were forced from the eastern Great Lakes into Wisconsin, resulting in an unstable situation where diverse groups were required to adapt to new environmental and social conditions.

The Fox-Wisconsin waterway was instrumental in the development of the early Northwest Territory. It was this route that Joliet and Father Marquette took in 1673 in their journey to ascertain that the Upper Mississippi River was the same river that emptied into the Gulf of Mexico. Another early pair of explorers using the waterway were Father Hennepin and Father Duluth, who blazed crosses on the trees as they passed. The only break in the waterway is the 1.3-mile portage between the two rivers. This portage, now paved, has been nationally registered to commemorate its prehistoric and historic importance.

The waterway was extremely important for the British Northwest Fur Company and the American Fur Company which succeeded it when the territory changed possession in 1814. Furs were transported from Prairie du Chien, the major trading center in the area, to the eastern warehouses by the waterway. The first permanent settler in Portage was a fur trader named Laurent Barth who built a trading post in 1792 and carried on the transport business. He was followed by Jean Lecuyer who used his team of oxen for crossing the portage. In 1810, Francis LeRoy took over the transport operation, dragging boats laden with furs and often weighing 10 tons across the portage bog.

In 1828, Fort Winnebago, one of three forts built to insure control of the waterway, was established at Portage to preserve peace between the fur traders and the Winnebagos. Fort Howard at Green Bay, Fort Crawford at Prairie du Chien, and Fort Winnebago were connected by a military road. Military occupation of the fort continued until 1845. The only remaining building of Fort Winnebago is the nationally registered Surgeons Headquarters, east of Portage.

The nationally registered Old Indian Agency House was built in 1832 for John Kinzie during the Blackhawk War. Kinzie was the Indian agent who represented the Winnebago in the sale of all their lands east of the Mississippi River to the Government in 1838. The agency house is on Old Agency House Road near the northeast city limits.

In 1876, a canal was completed connecting the Fox and Wisconsin Rivers at Portage. Although the canal was strategically located, the rivers were subject to low water levels, making the canal unusable at times.

Also, the construction of the railroad through Portage in 1857 made the canal less needed. The canal is being nominated to the National Register of Historic Places.

FLOOD PROBLEMS, OBJECTIVES, AND ALTERNATIVE SOLUTIONS

PROBLEM DESCRIPTION

Levees

The potential exists for a disastrous flood at Portage due to the topography of the area and past attempts to modify the flood flow characteristics of the Wisconsin River. Before construction of the existing levee system the floodwaters of the Wisconsin River left its

banks a few miles upstream of Portage and overflowed the low marshy land on both sides of the river. The portion overflowing to the south entered the Baraboo River, the lower part of which flows in the floodplain of the Wisconsin River. Overflows to the north inundated low-lying lands and eventually entered the Fox River.

From 1866 to 1880, farmers from Lewiston constructed a series of small levees for local protection. After the flood of 1881, levee repairs were made by Lewiston, the State, and the Federal Government. Most of the money for construction was provided by a drainage fund from the sale of marshland. In 1885, a levee was constructed on the south bank of the Wisconsin River to protect lands to the south and east. This levee was paid for by the township of Caledonia, also from the sale of marshland.

The confining of floodwaters by levees on both sides of the river upstream of Portage and the loss of flood storage in marshlands raised the height of floods at and below Portage. Thus, a levee was constructed on the north side of the Wisconsin River at Portage. This levee was completed by the Federal Government in 1890 for a total cost of $18,000. The Portage levee caused floodwaters to flow more freely on the south bank of the river opposite the city. In 1891, a levee was built on the south bank below the Route 78 bridge. This levee was paid for from the sale of marshlands.

In 1901, the Portage Levee Commission was established to maintain, raise, and extend the levees. The commission was abolished in 1961 and its duties were made the responsibility of the State. The levee system consists of almost 18 miles of discontinuous sand levees on both sides of the Wisconsin River upstream and downstream of Portage, affecting 13 miles of the river. The 9 1/2 miles of levees on the south bank of the river is referred to as the Caledonia levee

and prevents the flooding of some small farms, I-90-94, and the Pine Island Game Refuge. The 5-mile Lewiston and the 3 1/4-mile Portage levees on the north bank reduce the potential flooding of city property, farmland, highways, the railroad, and the Fox River basin.

Portage levee near the locks

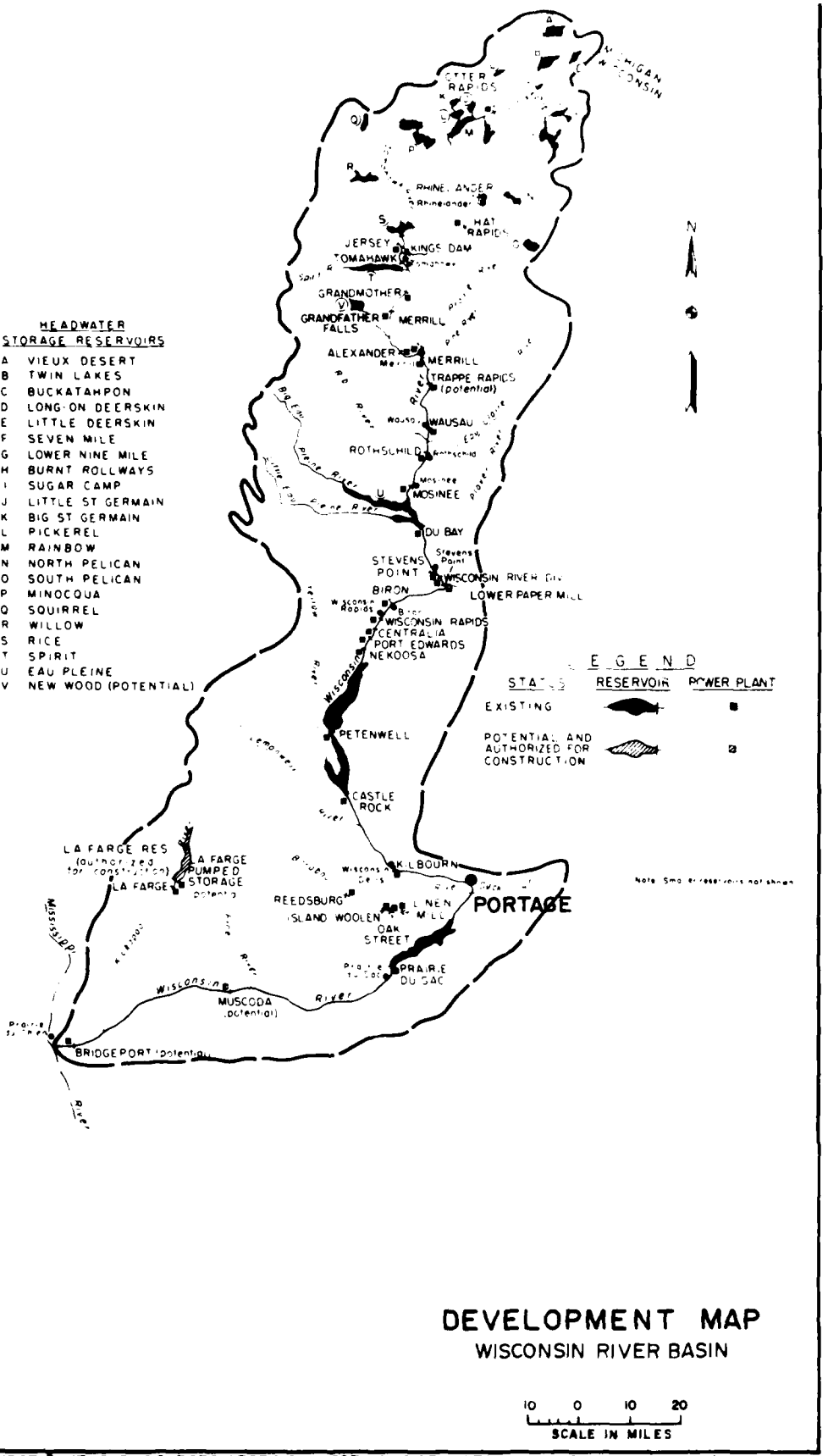
Dams and Reservoirs

Although no dams are in the study area, 21 storage reservoirs are in the headwaters of the Wisconsin River and 25 hydroelectric power dams are in the basin upstream of Portage. Four hydroelectric dams are on the Baraboo River. The operation of the dams and reservoirs is controlled by the Wisconsin Valley Improvement Company, generating power for utility and paper companies.

The 21 storage reservoirs are used to provide more uniform flows to the downstream hydroelectric dams. All the reservoirs are located over 200 river miles above Portage except for one on the Big Eau Pleine River, about 140 miles above Portage. Some of the reservoirs are lowered in anticipation of runoff from snowmelt, providing some flood protection to nearby areas in the spring. Flood peaks from spring runoff may even be reduced as far downstream as Portage. At other times of the year the availability of flood storage capacity is not dependable as the reservoirs could be nearly full at the time of a major storm. Also, large uncontrolled tributary drainage areas in the Wisconsin River basin contribute sizable quantities of storm runoff, diminishing the effect of the reservoirs even more.

Most of the hydroelectric dams are run-of-the-river type with only enough storage for daily power peaking demands. Only three of the dams, DuBay, Petenwell, and Castle Rock (134, 58, and 45 river miles above the Portage locks, respectively) have any flood storage capacity. However, as with the storage reservoirs, these dams are operated for optimum power generation and their effect on reducing flood peaks in Portage depends on their capacity at any particular time.

Therefore, because of their operation cycle and distance from Portage and because of the large uncontrolled drainage areas, the dams and reservoirs cannot predictably be relied upon to significantly reduce flood peaks at Portage. The locations of these power developments are shown on the following figure.



SOURCE: "WATER RESOURCES APPRAISAL FOR HYDROELECTRIC LICENSING, FPC, 1969"

Past Floods

Flows have been recorded on the Wisconsin River at Portage since March 1873 and at Wisconsin Dells since October 1934. Maximum daily flow from the National Weather Service staff gage at the Portage locks is read daily by a resident of Portage. The U.S. Geological Survey gage, about 3 miles downstream from Wisconsin Dells and about 11 miles upstream of the study area limits, is a digital water stage recorder.

Floods on the Wisconsin River at Portage occur from intense rainfall and snowmelt runoff. Major flooding in Portage also results from the overtopping and/or breaching of the levees. Flood backwater from Duck Creek can also cause flooding in Portage.

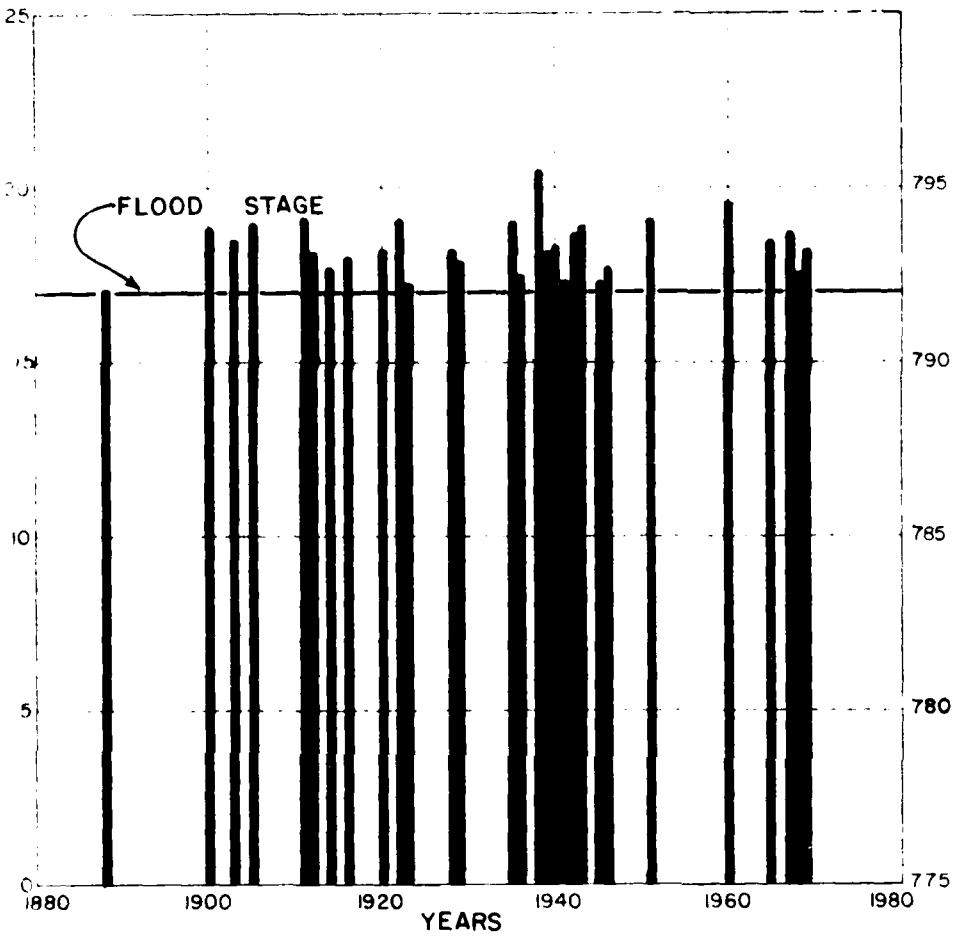
The flood of record occurred from abnormal rainfall runoff in September 1938 when a flow of 72,200 cfs (cubic feet per second) was recorded at Portage. The gage at the Portage locks registered a stage of 20.5 feet corresponding to an elevation of 795.6 feet above mean sea level. The Portage levee was breached with a 20-foot-wide gap which resulted in widespread flooding. The levee break would have been more serious if the river's main channel had not had to cross a lengthy swamp to the break.

Although the levees have not been breached since 1938, minor flooding has occurred regularly in the First Ward in Portage (downstream from the canal along the north bank of the river) and the Blackhawk Park residential area in Caledonia. Flooding has also occurred in the west side of Portage along the north bank of the river between Highways 33 and 78. Flood duration is relatively long on the Wisconsin River in the vicinity of Portage. Flows above flood stage may last as long as 8 days in extreme cases.

The figure on page 30 lists known stages and year of occurrence for floods since 1873. These floods have all exceeded the flood stage of 17 feet at the Portage locks. The following table lists in order of magnitude the 10 largest floods known. The recorded flows for spring floods (February through April) prior to 1950 would be somewhat less severe under existing conditions due to the construction of the Castle Rock and the Petenwell reservoirs.

Existing Floodplain Regulation Programs

Columbia County has adopted floodplain regulations approved by the Wisconsin Department of Natural Resources. The regulations are based on floodplain information reports for the Wisconsin River (Corps of Engineers, 1972 and 1975) and U.S. Geological Survey flood prone area maps. The hydrology and hydraulic analysis on which the regulations are based is being contested by a group of local citizens. The city of Portage has also developed a floodplain regulation ordinance but it has not been approved by the Department of Natural Resources. The hydrology and hydraulic analysis of existing conditions (see page 7) can be used as a basis to update the floodplain regulations for the city of Portage and Columbia County.



GAGE IS ON LOCKS IN PORTAGE, WISCONSIN AT MILE 116.0 ABOVE THE MISSISSIPPI RIVER

STAGES ARE ADJUSTED TO PRESENT GAGE ZERO OF 775.09 FEET MSL 1929 ADJUSTMENT.

FLOODS ABOVE FLOOD STAGE

WISCONSIN RIVER
PORTAGE, WISCONSIN

Highest ten known floods, Wisconsin River at Portage, Wisconsin

Order number	Date of crest	Maximum stage/feet*	Crest elevation/feet*	Peak discharge cubic feet per second
1	14 September 1938	20.5	795.59	72,200
2	27 March 1935	19.0	794.09	64,600
3	10 May 1960	19.6	794.69	63,300
4	12 April 1951	19.1	794.19	61,700
5	11 & 12 October 1911	19.2	794.29	59,800
6	14 April 1922	19.1	794.19	58,800
7	4 & 5 June 1943	18.9	793.99	57,500
8	11 June 1905	18.9	793.99	57,000
9	9 October 1900	18.8	793.89	56,200
10	5 April 1967	18.8	793.89	51,800

* 1929 Adjustment

Note: 1. Prior to October 1934, discharges are obtained from the rating curve at Portage. After October 1934, discharges are as recorded at the Wisconsin Dells gaging station and stage as recorded at Portage.

The following photographs show flooding in Portage.

present Shady Lawn Motel
First Ward - September 1938

Portage locks gage
September 1938

1209 West Conant Street
September 1938

House at 1025 West Carroll Street
September 1938

Flood scene in Portage - 1969

Typical flood conditions in the
Blackhawk Park area

Flood Warning Measures

The National Weather Service, U.S. Department of Commerce, provides rainfall and snowmelt advisory flood forecast service for major river basins and tributaries in Wisconsin, including the Wisconsin River. The system involves the prediction of river stage at a particular gage or gages in a basin, based on precipitation reports, flow at upstream points, and anticipated weather conditions. The flood forecast is transmitted to city officials and newspapers and radio and TV stations in the area for dissemination to occupants of the floodplain.

Upon receiving a warning, the Civil Defense Director, Portage Director of Public Works, and the Columbia County Sheriff's Department attempt to notify all property owners within the floodplain. During periods of high water behind the Caledonia levees, the Sheriff's Department routinely patrols the Blackhawk Park area to assist residents as this area is often inundated by floodwaters.

Portage's prevention measures include maintenance of the levees and retaining walls along the river within the city limits. During periods of rising floodwaters, the levees are constantly patrolled and reinforced as needed. All valves are closed on sewers going through the levees, and pumps are maintained at necessary street intersections to lift runoff water over the dike.

Portage has a unique interior drainage system in that most of the local surface runoff drains into the Fox River canal by gravity and does not have to be pumped over the levee into the Wisconsin River. Effluent from the sewage treatment plant also flows into the Fox River. These are big "plus factors" during a flood fight against a rising Wisconsin River.

Flood Potential

During the 1971 flood emergency, the Corps of Engineers assisted in strengthening and raising the levees at Portage. The existing levees, however, do not meet engineering design standards for permanent flood control projects as prescribed by the Corps of Engineers and the Wisconsin Department of Natural Resources. Previous analyses in the flood control reconnaissance report (1971) and the Flood Plain Information Report (1972) estimated that the largest flood of record (September 1938) has about a 10-percent chance of occurrence in any given year. This flood breached the Portage levee and inundated large portions of the study area. The two reports also estimated that floods having a 1-percent chance of occurring in any given year would breach the entire levee system resulting in extensive flooding in the city and adjacent townships.

Additionally, a related flood potential exists because Portage is on the divide between the watersheds of the Wisconsin and Fox Rivers, at the point where these rivers are only 1 1/2 miles apart. At normal stages, the Wisconsin River at Portage is about 6 feet above the elevation of the Fox River. This difference can increase to as much as 20 feet during extreme floods on the Wisconsin River, resulting in extensive overland flooding into the Fox River. The resultant high flows on the Fox River could cause flood damages to downstream areas.

STUDY OBJECTIVES

The study objectives presented below will guide the preliminary formulation of alternatives. The objectives will be modified as the study progresses and specific concerns become evident. As stated earlier, all Federal water resources projects are planned to achieve the two national objectives of national economic development and environmental quality. More specific objectives are to:

a. Develop an effective flood control plan that is acceptable to area residents and responsive to their needs.

b. Enhance social well-being and recreation potential, where possible.

c. Preserve the archeological and historical value of the area.

The citizens committee has recommended that the Corps:

a. Evaluate the methodology of river flow rate determinations between Wisconsin Dells and the Prairie du Sac dam and report to the committee. The methodology should be consistent with river flow history including the storage capacities of upriver dams and reservoirs and changes in flow patterns.

b. Determine the discharge capacity of the river at Wisconsin Dells through a hydraulic study to be balanced against the hydrology of the downstream area to the Prairie du Sac dam. A study of the hydraulics of the wells should be included.

c. Study the reservoir capacity downstream and storage in low areas outside the levees and simulate storage area effects by topping the levees but not considering their destruction.

d. Use data gathered by railroad engineers and the Wisconsin Department of Transportation on the history and effects of the road-bed and railway fills on water flow patterns.

e. Consider channel improvements and maintenance, including removal of sandbars and islands, use of wing dams, and control of brush and tree growth in the floodway between levees.

f. Check the effects of the Baraboo River regarding interplay on areas of consideration.

g. Check the effects of the Fox River regarding interplay of separate river basins in the area of consideration.

h. Check the hydraulics of the Fox River valley and the impacts of Wisconsin River overflows into the valley.

i. Evaluate the operation of the Prairie du Sac Dam spillways within the constraints of the Public Service Commission.

j. Evaluate and recommend operating procedures for the Castle Rock and Petenwell Dams and Reservoirs within the constraints of the Public Service Commission.

k. Evaluate the following alternatives:

(1) Construction and maintenance of levees for total protection of all property or a lesser degree of protection to minimize damage to property downstream or consider control structures to bypass excessive flows.

(2) Consideration of available soils for levee construction and maintenance.

(3) Determination of funding.

(4) Determination of what flow can cost-effectively be contained within the levees through Fairfield and Newport downstream to Lake Wisconsin and how to handle excess flows above that amount.

l. Report to the committee after each procedural step for review and comments.

The city of Portage has expressed the need to protect residents along the north bank of the Wisconsin River between Highways 33 and 78.

The U.S. Fish and Wildlife Service has stated that efforts be made to:

a. Preserve and enhance the sport fishery in the project area.

b. Protect floodplain habitats and their wildlife.

c. Consider Wisconsin Department of Natural Resources lands and other public lands that might be impacted.

d. Protect endangered or threatened plants and animals and their habitats.

e. Consider the Aldo Leopold Memorial Reserve.

The Wisconsin Department of Natural Resources has indicated the study should:

a. Develop a hydrologic and hydraulic analysis as outlined in the interagency scope of work including evaluation of the effects of upstream reservoirs, storage, and interbasin flow and delineate the hydraulic floodways in the Portage area.

b. Consider levee protection for Portage along the south bank of the river and along the north bank upstream, downstream, and in Portage.

c. Consider relocating structures in the city on the south bank of the river.

d. Consider fee title purchase of flooded lands.

RANGE OF POSSIBLE ALTERNATIVES

All possible alternatives for flood control will initially be examined as to their feasibility and application in the Portage area. Alternatives to be studied include:

a. Base line or "without project" condition.

b. Improve existing levees.

c. Degrade portions of Caledonia levee upstream of Portage.

d. Channel modification.

e. Channel diversion.

f. Construct new upstream reservoirs.

g. Increase flood control storage of upstream dam(s).

h. Floodplain management.

The "without project" condition will be used as the base line with which to compare the other alternatives. The "without project" condition will also be evaluated using the same criteria as for the other plans.

Alternative b would raise, strengthen, and extend the existing levees. Improvement of levees on the north bank of the river (Lewiston and Portage) was the plan recommended in the 1971 flood control reconnaissance report. Additional levee protection on the north bank between Highways 33 and 78 will be investigated as requested by the city of Portage. The feasibility of improving the Caledonia levee will also be evaluated.

Alternative c would degrade portions of the Caledonia levee to allow flood storage in the wetlands behind the levee. Additional measures, such as dikes, may be necessary to prevent damage to highways and property outside the wetlands areas.

Channel modification, alternative d, would involve clearing and enlarging the river channel to safely convey large floods within the banks of the river.

Alternative e would divert potential floodwaters from the Wisconsin River into a bypass channel(s) away from developed areas and eventually return them to the Wisconsin River. Diversion of a portion of Wisconsin River floodwaters into the Fox River will also be investigated.

Alternative f would involve construction of reservoirs to regulate runoff from presently uncontrolled upstream tributaries.

Alternative g would increase flood control storage in some or all of the following dams: Castle Rock, Petenwell, DuBay, and Eau Pleine. Of the dams in the basin, these have the best potential for reducing flood flows because of their size and proximity to Portage. The dams could be raised to provide more storage for flood control while maintaining the present storage for power generation. Economic feasibility will depend on the extent of present development in the areas which would be inundated by the higher dams. Another method of increasing storage would be to lower the present lake level which would reduce power generation.

Alternative h, floodplain management, is a nonstructural approach. This alternative could include flood proofing of individual structures, permanent evacuation and relocation of residences and businesses in severe hazard areas, flood insurance (study in progress), improvements in the existing flood forecast and warning systems, and land use controls such as zoning to limit the amount and type of floodplain development.

Possible combinations of the above alternatives will also be investigated.

WORK ITEMS, SCHEDULING AND COSTS

WORK ITEMS

Work will first be directed toward establishing the base line condition; i.e., determining the existing and projected "without project" or "no action" conditions. The likelihood of future floods will be assessed assuming no flood control improvements. The existing environmental, social, and economic profile of the study area will also be established and projected to estimate the future study area setting. In this way, the probable magnitude and type of future flood related problems can be estimated. Alternatives to solve these problems will then be formulated and the beneficial and adverse changes associated with each alternative will be assessed by comparing them to the base line condition.

To make sound planning decisions, information from various types of investigations is required. The inventories and analyses needed to provide a decision-making basis for the feasibility study include the following work items.

Surveying and Mapping

Field surveys will be conducted to obtain cross section and/or profile data on river channels, bridges, levees, and roadways in the floodplain. These data will be used in the hydrology and hydraulics analysis to determine flood flow characteristics. For design purposes, surveys and mapping will be required for locations where levees, channel diversions, or other alternatives are proposed.

Interagency Hydrology and Hydraulic Analysis of Existing Conditions

An interagency effort will be made to develop a flood flow and low-flow analysis of existing (without project) conditions for the Wisconsin River main stem. The analysis will determine:

a. The flood flows and low flows for 28 cities and villages and 15 counties along the river (see the table on page 45).

b. The extent of flooding in the Portage area including the effects of storage and interbasin flows.

c. Flood profiles of the river through Columbia County.

The U.S. Geological Survey will develop the hydrology (i.e., determine flood flows) from the headwaters to the Portage area. An analysis of the effects of storage reservoirs and hydroelectric dams will be included. On agreement of these flow data, the Corps will develop flood profiles for the river through Columbia County. Storage capacity behind the levees and the effects of interbasin flow to the Fox River will be considered. Discharges for various floods will be determined at Portage and the downstream end of Columbia County. The Geological Survey will then determine flood flows down the remaining reach of the river to the Mississippi River. A low-flow analysis of the Wisconsin River main stem will also be developed by the Geological Survey. The Wisconsin Department of Natural Resources will direct and coordinate the analysis and provide some of the study funds. The analysis of existing conditions is scheduled for completion by October 1978. The methodology for the analysis is described more specifically below.

Methodology for Hydrologic Analysis. - The following methodology will be used by the Geological Survey to determine flood flows and low flows for communities and counties along the Wisconsin River:

a. Reconstruct "natural" flow history of daily discharges for all gaging stations on the Wisconsin River by removing storage effects of reservoirs.

(1) Convert records of daily or weekly change in storage to an equivalent daily discharge (plus or minus).

(2) Route the equivalent discharges to the gaging stations downstream to determine "natural" flows at all gaging stations (daily routing).

(3) Use a percentage of the "natural" flow generated in (2) for ungaged contributions in subsequent routing.

(4) Analyze unregulated flow for high and low frequency.

b. Using a digital routing model, extend streamflow records at all gaging stations. It may be possible to extend the records back to 1914. This will depend on a reverse routing technique which has been used successfully in some cases and failed in others due to numerical instability in the modeling process. If the technique fails, modeling will need to be limited to about 1936 to the present (limited by length of record of the Wisconsin River at Rainbow Lake and Big Eau Pleine River near Stratford, Wisconsin). Daily discharges will be synthesized for unregulated conditions for all gaging stations over the extended period.

(1) Attempt to extend the record of Wisconsin River at Rainbow Lake to 1914 by reverse routing from Whirlpool Rapids using "natural" flows computed in a.(2).

(2) Attempt to fill in missing years (1926 to 1936) in the record of Big Eau Pleine River near Stratford using a model rerouting "natural" flows from Merrill to Knowlton, Wisconsin, on the Wisconsin River, calibrated using the record from Stratford as part of the tributary inflow; then running the model for years of no record at Stratford and determining the Stratford flows from the differences between routed and actual flows at Knowlton.

c. Impose the current operating rules of the reservoir system and synthesize daily discharges for all gaging stations over the entire extended period.

(1) Rainbow Lake, Big Eau Pleine Reservoir, and Lakes DuBay, Petenwell, and Castle Rock will be modeled individually using routed flows from upstream.

(2) The remaining reservoirs will be lumped into three or four conceptual reservoirs whose inflow is estimated by a percentage of the "natural" flow at Rainbow Lake (or possibly Whirlpool Rapids).

(3) Applying current operating rules to all reservoir systems, route entire period as far as Wisconsin Dells.

d. Analyze flow data for flood flow and low-flow frequency and duration.

(1) For each site in the following table, do a frequency analysis of the highest mean discharge for 1, 3, 7, 15, 30, etc., consecutive days.

(2) From the volumes for the 10-, 50-, 100-, and 500-year flow rates in d (1) and the shape of recent large floods, estimate a hydrograph of the 10-, 50-, 100-, and 500-year flood at each site.

e. After effects of storage and interbasin flow at Portage are analyzed, route 10-, 50-, 100-, and 500-year flood hydrographs down remaining reach of river.

Sites along the Wisconsin River

Counties	Communities
Adams	Arena, Iowa County
Columbia	Avoca, Iowa County
Crawford	Biron, Wood County
Dane	Blue River, Grant County
Grant	Boscobel, Grant County
Iowa	Brokaw, Marathon County
Juneau	Lone Rock, Richland County
Lincoln	Merrill, Lincoln County
Marathon	Merrimac, Sauk County
Oneida	Mosinee, Marathon County
Portage	Muscoda, Grant County
Richland	Nekoosa, Wood County
Sauk	Plover, Portage County
Vilas	Portage, Columbia County
Wood	Port Edwards, Wood County
	Prairie du Sac, Sauk County
	Rhinelander, Oneida County
	Rothschild, Marathon County
	Sauk City, Sauk County
	Schofield, Marathon County
	Spring Green, Sauk County
	Stevens Point, Portage County
	Tomahawk, Lincoln County
	Wausau, Marathon County
	Wauzeka, Crawford County
	Wisconsin Dells-Columbia County
	Wisconsin Rapids, Wood County
	Woodman, Grant County

The model will be multiple linearization, taking into account both wave dispersion (dampening) and wave celerity. Background information on the modeling procedures to be applied can be found in:

a. Keefer, Thomas N., "Desktop Computer Flow Routing," American Society of Civil Engineers Proceedings Journal, Hydraulics Division, HY 7, Proceedings Paper 10669, 1974, pages 1047-1058.

b. Keefer, Thomas N., and Paul S. McQuivey, "Multiple Linearization Flow Routing Model," American Society of Civil Engineers Proceedings Journal, Hydraulics Division, HY 7, Proceedings Paper 10668, 1974, pages 1031-1046.

Hydrology and Hydraulic Analysis for Portage and Columbia County. - The following methodology will be applied by the Corps to determine the effects of storage and interbasin flow, flood discharges, and the extent of flooding in the Portage area; flood profiles of the Wisconsin River through Columbia County; and flood discharges at the downstream end of Columbia County.

a. Areas to be considered for flood storage under existing conditions include:

(1) Duck Creek, backflow to the Fox River.

(2) Right bank opposite Duck Creek (Blackhawk Park).

(3) Behind Caledonia levee, north of and just south of Highways 33 and 78.

(4) Behind Portage levee and U.S. Highway 51 with possible flow to the Fox River.

(5) Behind Lewiston levee in Big Slough area.

b. Draw area capacity curves for storage areas.

c. Identify control on each storage area.

d. Determine water surface profile of Wisconsin River through Columbia County. Assume all levees effective and determine sequence of levee overtoppings and effects on water surface profile for various sequences and flows.

e. Develop water surface profiles and rating curves at control points for Neenah Creek and Fox River in the study area.

f. Route flows through storage areas using reservoir routing techniques. Adjust water surface profiles to account for storage and interbasin flow effects.

g. Determine 10-, 50-, 100-, and 500-year, standard project, and design discharges at Portage and 10-, 50-, 100-, and 500-year discharges at the downstream end of Columbia County.

h. Make a sensitivity analysis of the effects of changing land use on flood flows at Portage.

i. Develop a profile for the 100-year flood along the Fox River where significant damages from Wisconsin River overflows may occur.

Hydrology and Hydraulic Analysis of the Alternatives

The analysis of the flood control alternatives will primarily be a Corps effort. The probable frequency of occurrence, extent of flooding, and other characteristics will be determined for each alternative. The procedures and models to be used for analysis of the alternatives are basically the same as those described to determine the existing conditions. If modifying the existing levees is a viable alternative, a comprehensive analysis will be made of the interior drainage system including the design of pumping station facilities. The results of the hydrology and hydraulic analysis will be used to determine the design and cost requirements of each alternative and provide a basis for the estimation of flood damages.

Foundations and Materials Investigation

A geological study will be made in the vicinity of the proposed project areas to determine the general characteristics of subsurface materials and locate sources of construction materials. When selection of the most feasible alternative(s) is made, borings and soil testing will be conducted. The existing levees will also be analyzed to estimate the extent of seepage, uplift, and stability problems. Engineering designs will be prepared for proposed earth

embankments such as levee construction and for the foundation
all proposed structures. Also, for any structural measures
a rough assessment, coordinated with the U.S. Bureau of Mines,
be made of the possible underlying mineral values which may

Design and Cost Studies

Alternatives will be formulated to a comparable level
and cost detail for each iteration. Design and cost estima
cedures will initially be general and include only major el
of the alternatives. For the final set of alternatives, st
designs and costs will be developed for individual project
such as gate wells, pumping structures, conduits, road relo
and bridge raises. These designs will, however, be prelimin
not sufficiently detailed for project construction. Costs
alternative will include an estimate of all construction, or
maintenance, and replacement costs expected during the desi
the project.

Economic Study

The economic study will establish the relationship be
magnitude of a given flood and the resulting economic dama
from hypothetical floods will be estimated from historic fl
data, existing and projected land use, population projection
nomic profile (employment data, existing and projected per c
income, etc.), and an estimate of existing and projected val
residential, commercial, industrial, and public property. P
flood damages throughout the planning period will then be es
the base line condition and for each alternative. The diff
tween flood damages for the base line condition and those f
alternative represents economic benefits for the considered alternative.
Additional economic benefits such as increased market value
protected from flooding and increased local employment for
and maintenance of an alternative will also be assessed.
alternatives that do not generate at least $1 of benefits
$1 of costs are not considered for further study.

Institutional Analysis

An inventory will be compiled of all organizations having functions or interests relevant to water resources planning. The goals, resources, and legal and customary functions of each organization will be specified to give a clear picture of the area's commitments and capabilities. The capability of the existing institutions to implement, manage, and finance each alternative will then be analyzed. Modifications to the existing institutions and/or the need for new institutions will also be investigated.

Water Quality Study

Existing data will be used to estimate current water quality conditions in the study area. The effects of the alternatives on water quality will also be given preliminary examination. More detailed studies will be conducted if significant water quality impacts are expected from implementation of an otherwise acceptable alternative. For example, should reservoir construction appear to be a viable alternative, a comprehensive water quality sampling program and analysis will be initiated. Alternatives allowing interbasin flow will also be analyzed to determine possible impacts of Wisconsin River overflows on the water quality of the Fox River. This work will be coordinated with the Wisconsin Department of Natural Resources, the Fox Valley Water Quality Planning Agency, and the U.S. Environmental Protection Agency.

Environmental Analysis

The environmental base line will be established from inventories of fish and wildlife, forests, wetlands, and other natural resources. Endangered and threatened species and ecologically productive and sensitive areas will be described. Past trends and projected changes in the area's natural resources will also be discussed. The environmental impacts of the alternatives, such as changes in aquatic ecology or disturbances in the natural land environment, will be determined by comparing each alternative to the base line environmental setting. Measures to mitigate any severe adverse impacts or enhance any beneficial impacts associated with the alternatives will also be investigated. Probable adverse effects which cannot be avoided will also be discussed. The environmental analysis will be accomplished in a

joint effort with the Fish and Wildlife Service. The Service has responsibility for the preparation of reports on fish and wildlife aspects of water resources projects as required by the Fish and Wildlife Coordination Act of 1958. The Fish and Wildlife Service will provide its currently available data such as the wetlands inventory for Columbia County, an assessment of the fish and wildlife impacts of the alternatives, and an identification of enhancement and mitigation measures.

Outdoor Recreation Study

Outdoor recreation facilities in the study area will be inventoried with regard to location, capacity, and types of experience offered. Per capita recreation use rates will be determined for study area residents and nonresidents and projections made for trends in participation. By determining the existing and future supply and demand, the study area's outdoor recreation needs will be identified. Much of the base line data can be obtained from the Bureau of Outdoor Recreation and the State Outdoor Recreation Plan. The beneficial and adverse impacts of each alternative on recreation opportunities will also be assessed. For each final alternative, a conceptual recreation plan will be developed in coordination with potential sponsors and agencies who have interests and responsibilities in outdoor recreation.

Cultural Resources Study

A cultural resources reconnaissance will be conducted to inventory all areas of known historic and prehistoric significance, gather background information about the prehistoric habitation of the general area, and obtain information about the sites listed and those eligible for registration in the National Register of Historic Places. For those areas potentially affected by the alternatives, information will be gathered concerning possible location and importance of presently unknown prehistoric and historic sites. For the final alternatives, the eligibility of any sites for inclusion in the National Register will be determined for the impact area. The cultural resources study will be accomplished in close cooperation with the State Historical Society of Wisconsin.

Social Study

A social profile will be made of the population in the study area. Profile characteristics include data on employment, age distribution, education, and other descriptors which specify the composition and organization of the local social system. The profile will be comparative by providing parallel information on the study area and the State and, on some items, the Nation. The social effects generated by each alternative such as relocation of homes, changes in development patterns, public safety, and aesthetic perceptions will be compared to the base line social profile. The analysis will estimate, relative to the State or national comparative base, whether the local inhabitants gain or lose with the selection of a given alternative.

Real Estate Appraisal

A real estate study will be conducted to determine which lands are needed for project construction, operation, and maintenance of the final alternatives. A gross appraisal will be made of the necessary easements, purchases, and associated costs in obtaining the rights-of-way for each alternative.

Coordination with the Chicago District

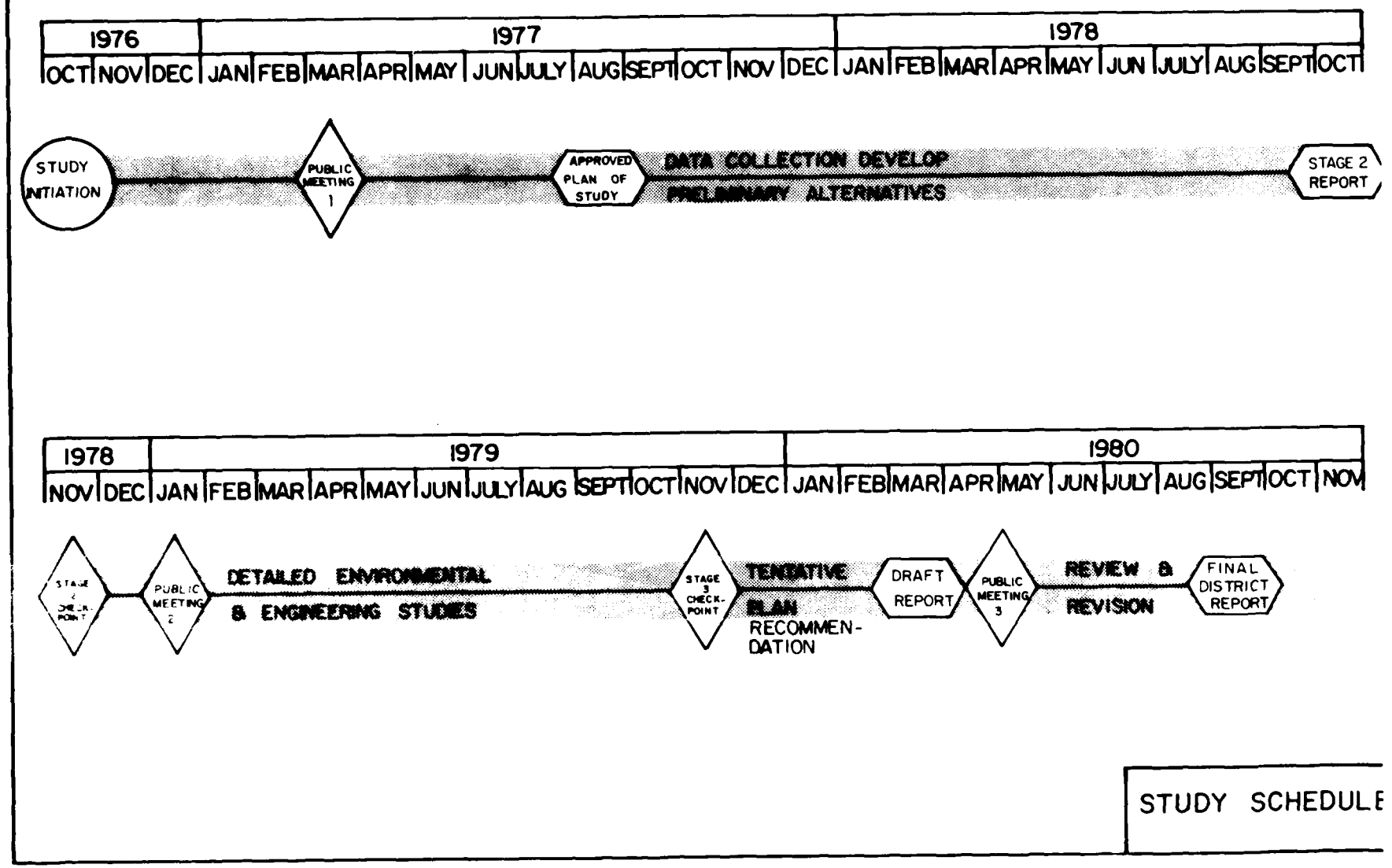
Floodwaters from the Wisconsin River will overflow into the Fox River if the levees along the north bank are topped or breached. The resulting high flows in the Fox River could cause damages to land and communities along the Fox River. The general magnitude of potential damages will be assessed to determine the severity of the problem. Since the Fox River basin is within the jurisdiction of the Chicago District of the Corps of Engineers, coordination has been initiated to establish the information to be provided by Chicago District.

STUDY SCHEDULE

The feasibility study for the Wisconsin River at Portage is estimated to take 4 years to complete. As the study is a cooperative Federal, State, and local effort, the schedule and work items will be coordinated with all participants to obtain agreement on study responsibilities and avoid scheduling conflicts and duplication of effort. Tentative completion dates for the study milestones are presented in the following table. A general schematic of work to be performed during this study is shown in the figure on page 53.

Milestone schedule

Milestone		Estimated completion date
	Stage 1 planning	
1	Study initiation	Nov 1976
2	Approved Plan of Study (by Corps North Central Division)	Aug 1977
	Stage 2 planning	
3	Stage 2 report	Oct 1978
4	Stage 2 checkpoint conference (with Division office)	Nov 1978
5	Completion of action on memorandum for the record (resolution of issues discussed at checkpoint conference)	Jan 1979
	Stage 3 planning	
6	Submit draft report and draft environmental impact statement to Division	Nov 1979
7	Stage 3 checkpoint conference (with Division)	Nov 1979
8	Completion of action on memorandum for the record (resolution of issues discussed at checkpoint conference)	Jan 1980
9	Coordination of draft report and draft environmental impact statement (distribute to other agencies and public for comments)	Mar 1980
10	Submit final report and revised draft environmental impact statement	Aug 1980
11	Release of Division Engineer's public notice and submission of report to Board of Engineers for Rivers and Harbors	Sep 1980



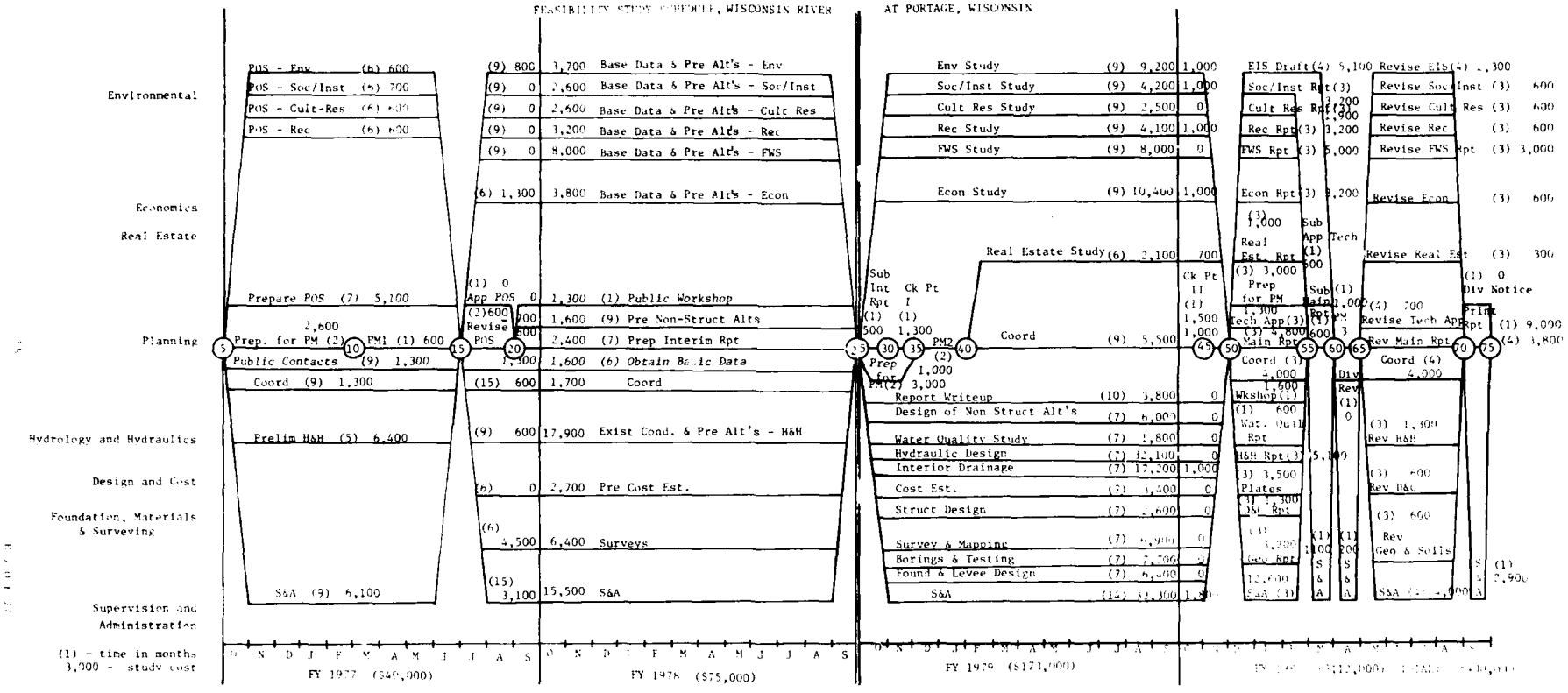
STUDY SCHEDULE

STUDY COST

The following schedule estimates the funding required to meet the feasibility study completion date of September 1980. The schedule shows the estimated time in months and the cost for each work item. It was prepared on the basis of the actual fiscal year 1977 appropriation of $40,000 and the expected appropriation of $75,000 for fiscal year 1978. Not included in the schedule are funds from other agencies to be used for the interagency hydrology and hydraulics analysis of existing conditions. This interagency effort will be funded as follows:

U.S. Geological Survey	$52,500
Wisconsin Department of Natural Resources	52,500
Corps of Engineers	50,000
Total	155,000

Approximately $10,000 of the Corps funds will be obtained from floodplain management study funds (not included in the cost schedule). These funds will be provided because the interagency analysis will benefit the existing Special Flood Hazard Information Study at Stevens Point, Wisconsin, and future floodplain studies at other locations along the river.


FEASIBILITY STUDY SCHEDULE, WISCONSIN RIVER AT PORTAGE, WISCONSIN
Environmental
Economics
Real Estate
Planning
Hydrology and Hydraulics
Design and Cost
Foundation, Materials & Surveying
Supervision and Administration
(1) - time in months
3,000 - study cost
FY 1977 ($40,000)
FY 1978 ($75,000)
FY 1979 ($173,000)

PARTICIPATION AND COORDINATION

PUBLIC INVOLVEMENT PROGRAM

The purpose of the public involvement program is to: (1) keep the public informed of the results and implications of study activities, (2) promote an understanding of why certain decisions were made, and (3) obtain opinions from the public regarding plan development and selection.

To achieve these purposes, three public meetings will be held during the study. At the first meeting, held on 30 March 1977, the background of and reasons for the study were discussed and an outline of how the study will be conducted was provided. Spokespersons for Representative Robert Kastenmeier and the Department of Natural Resources stated their support for the study and encouraged citizens to provide input to the citizens committee. The second public meeting, scheduled at the end of Stage II studies, will focus on the formulation and assessment of a range of alternatives. The third public meeting will present a final set of alternatives for public consideration and a recommendation for one of the alternative plans. A public notice will be distributed 1 month before each meeting. Information fact sheets of study progress will also be provided periodically.

To insure that local views are adequately considered in the planning process, a citizens committee has been established. The committee represents a broad spectrum of interests with a common concern for water and related land resources planning. The committee has had several meetings and has submitted a list of objectives and concerns (see "Study Objectives"). Progress reports will be prepared to keep the committee informed and provide a basis for obtaining local inputs. Present committee members are:

Harold Vik, Chairperson	Art Bailey
Candy Bulgrin, Vice-chairperson	Robert Hoffer
Frederick Haerter, Secretary	Ed Kramer
Francis W. Murphy	Leon Heinze
Hugo Traub	Kenneth Scherbert
Otto Tofson	Robert Irwin
Sam Pate	(advisory member)

COORDINATION

The feasibility study will continue to be a cooperative effort with concerned Federal, State, and local agencies. In particular, the Corps will work closely with the Wisconsin Department of Natural Resources since this agency has responsibility for providing flood protection for Portage.

Interagency meetings will be held involving representatives from all agencies desiring to actively participate in the planning process. The meetings will be held to provide guidance and obtain agreement in the development and selection of alternatives, acquire current information and avoid duplication of effort, and insure that the study does not conflict with the regulations and policies of any agency. Study recommendations will result mainly from joint interagency decisions and the views of the local citizens.

All interested agencies, whether actively participating or not, will be kept informed of study progress and given the opportunity to express concerns. Agencies which have expressed an interest in this study to date are:

Federal

U.S. Department of Agriculture

Soil Conservation Service
Forest Service

U.S. Department of Housing and Urban Development

Federal Housing Administration
Federal Insurance Administration

U.S. Department of the Interior

Bureau of Indian Affairs
Bureau of Mines
Bureau of Outdoor Recreation
Fish and Wildlife Service
Geological Survey
National Park Service

Environmental Protection Agency, Region V

State of Wisconsin

Department of Natural Resources

Department of Transportation

Division of Highways

State Historical Society

Local

City of Portage Department of Public Works

Columbia County Zoning and Planning Committee

LOCAL COOPERATION

If a feasible and acceptable project is recommended, the final report will identify the non-Federal obligations. For flood control projects, the non-Federal sponsor(s) is generally required to:

a. Provide all lands easements, rights-of-way, and relocations and all operation and maintenance costs necessary for the project.

b. Hold and save the United States free from damages due to the construction, operation, and maintenance of the project except for damages due to the fault or negligence of the United States or its contractors.

c. Comply with applicable provisions of the "Uniform Relocation Assistance and Real Properties Acquisition Policies Act of 1970 (Public Law 91-646."

For this reason it is necessary to identify a potential project sponsor(s).

The feasibility report must include a letter of intent from a properly authorized non-Federal public agency stating its ability and willingness to cooperate. This letter of intent could come from the State of Wisconsin through the Department of Natural Resources, Columbia County, the city of Portage, or some other properly authorized agency.

If upon review of the feasibility report Congress authorizes a project, a formal agreement or contract with the non-Federal sponsor(s) will be required during the advance engineering and design studies.

RECOMMENDATION

Approval of the plan of study presented herein is recommended.

FORREST T. GAY, III
Colonel, Corps of Engineers
District Engineer

WISCONSIN RIVER AT PORTAGE, WISCONSIN
FEASIBILITY STUDY FOR FLOOD CONTROL
PLAN OF STUDY

APPENDIX A

COORDINATION LETTERS

ST. PAUL DISTRICT, CORPS OF ENGINEERS
AUGUST 1977

APPENDIX A

COORDINATION LETTERS

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APPENDIX A

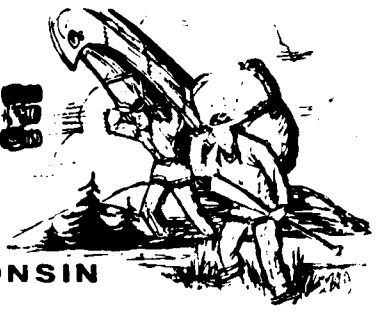
COORDINATION LETTERS

Coordination with local, State, and Federal agencies and committees is an integral part of the feasibility study for guiding plan development and avoiding duplication of effort. The following comments concerning the feasibility study and draft Plan of Study were incorporated, insofar as possible, in this report.

CITY OF PORTAGE

"Where the North Begins"

● PORTAGE, WISCONSIN



30 March 1977

OFFICE OF
DEPARTMENT
OF PUBLIC WORKS

Colonel Forrest T. Gay
District Engineer Corp of Engineers
St. Paul District

Re: Floodplain Study.

Dear Colonel Gay:

In regard to the study which the Corp of Engineers will be conducting in the Portage area as per the draft plan of study distributed by your office, I would like to request on behalf of many residents in the area on the west side of the city adjacent to the Wisconsin River, that the Corp consider extending the Lewiston levee along the North bank of the Wisconsin River from the bridge which takes Highway 33 across the river, thence in a northwesterly direction until it would tie into the existing Lewiston levee in the area of State Trunk Highway 78. This would facilitate protection for the people in that area where flooding has been known to occur in the past.

Thank you and your office for consideration in this matter.

Sincerely,

Frederick A. Haerter, P. E.
Director of Public Works

FAH:bt

cc: Ald. Scherbert

INVESTIGATIONS AND REPORTS. PLANS. SPECIFICATIONS
ESTIMATES. SURVEYS. SUBDIVISIONS
AND BUILDINGS

MUNICIPAL IMPROVEMENTS. WATERWORKS. SEWERS
SEWAGE TREATMENT WORKS. PAVEMENTS
PARK DEVELOPMENT

GENERAL ENGINEERING COMPANY, INC.
CONSULTING ENGINEERS

H. O. VIK
E. T. ERNST
J. O. HAMEL

317 DEWITT STREET
P. O. BOX 340
PORTAGE, WISCONSIN 53901

PHONE
608-742-2169

May 25, 1977

Department of the Army
St. Paul District
Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

SUBJECT: Wisconsin River at Portage, Wisconsin
Feasibility Study for Flood Control

Gentlemen:

Pursuant to the Corps of Engineers request for public involvement in the Wisconsin River Feasibility Study for Flood Control at Portage, Wisconsin, Mayor Riley of the City of Portage and Herbert Raether, Chairman of the Columbia County Board, appointed a Citizen's Committee, including representation from the City of Portage, the Township of Lewiston, and the Township of Caledonia in Columbia County, together with representation from the Township of Fairfield in Sauk County, Wisconsin.

A meeting of that Committee was held on Wednesday, the 4th day of May, 1977, at which time, numerous recommendations were made relative to the feasibility study. The minutes of the meeting were circulated to all committee members for review and comment and a few comments were made to initiate the May 24, 1977 additions to the minutes. A copy of the minutes is enclosed.

The committee requests that the Corps of Engineers prepare the project in accordance with the guidance provided by the minutes. In the event that you feel there are some omissions or some conflicts, we ask that you contact the writer without delay.

We feel that we have a well diversified committee with active constructive thoughts and ideas and the committee stands by to take prompt action on any matters coming to its attention. It is expected that there will be no compensation for the committee members' time. However, we do ask that committee expenses be considered a part of the project cost.

We will look forward to receiving a proposal package from the Corps of Engineers in the near future.

Yours truly,

Harold O. Vik

Harold O. Vik, Chairman
Wisconsin River Flood Control
Citizens Committee

HOV:cs
Enc.

WISCONSIN R VER FLOOD CONTROL CITIZENS COMMITTEE, Wednesday, May 4, 1977 - 9:00 [illegible]

MEMBERS PRESENT: Harold Vik, Chrm., Candy Bulgrin, Vice Chrm., Frederick Haertel, Francis W. Murphy, Hugo Traub, Otto Tofson, Sam Pate, Art Bailey Robert Roffer, Ed Kramer, Leon Hainza, Kenneth Schubert.

Also Present: DNR Rep. Terry Hampton, WPDR Newsman Thom Garreteon, Daily Register Staff Jack Kelly, Marcus Gums of Fairfield and Robert Irwin.

Business:

A. Chrm. Vik directed Secretary Thurston to read the minutes of April 27, 1977 [illegible]. After reading of the minutes, they were corrected to read members Schubert and [illegible] not shown in that they were not notified and that Robert Irwin will be an advisory [illegible] ber only on this committee.

B. Chrm. Vik directed Sec. Thurston to read the recommendations from Rep. Terry [illegible] requesting notification and information regarding the meetings held by this [illegible]. On a motion by Murphy, second by Traub that Terry Thompson be sent minutes of [illegible] ings. It was amended to include Rep. Pete Litscher, Senator Bidwell and Congressman Robert Kastenmeier. This motion passed.

Chrm. Vik then stated the general direction which he felt his committee should be taking at this meeting. He stated that all recommendations from outside the committee [illegible] submitted in writing so that there is no misconstruing of ideas or statements. Co[illegible]man Murphy added that stated objectives should be reasonable, the committee should work with the Corps and the DNR to make sure this study is a working tool.

Study Objectives and Procedures:
A general discussion by the committee followed and items were discussed between [illegible] ranging from the flow, the levees, zoning, federal guidelines which the Corps is required to follow, and the effects of the upstream dams; specifically mentioned by Committeeman Murphy were the Castle Rock and Petenwell Dams and flowages which were built in the [illegible] 20 years and which he felt were very important to the decision which Corps make in regard to this study. Several suggestions in the general discussion were to check the [illegible] of the dams, and study the hydraulics of the narrows at the Dells. It was agreed by the committee shall insist that the Corps of Engineers reveal the methodology they will use in projecting future flood flows to determine the records of past performance of how flood is with present models of river conditions and that the records prior to the construction of Petenwell and Castle Rock Dams be placed in proper perspective with the make up of the records and performance since that construction. Chairman Vik then moved and that the committee list the actual items in numbered sequence with no specific order as to what they wants the Corps of Engineers to point their study towards. These items are as follows:

1. Request that the methodology of river flow rate determinations for the area between Wisconsin Dells and the Prairie du Sac dam be re-evaluated and reported to the committee.
2. Recommendation that such methodology be consistent with River flow history while taking into consideration the storage capacities of up River dams and reservoirs as well as changes in flow patterns.
3. Determination of the discharge capacity of the River at Wisconsin Dells through a hydraulic study to be balanced against the hydrology of the downstream area relating to the Prairie du Sac dam. This should include a study of the hydraulics of the narrows at the Dells.
4. Study the reservoir capacity downstream, together with storage in low areas outside of the levees. - Simulate storage area effects by topping the levees but not considering the destruction of them.
5. Use the data gathered by Railroad engineers and the Wisconsin Department of Transportation in respect to the history and effects of the roadbed and highway fills on water flow patterns.
6. Consideration of channel improvements and maintenance, including removal of [illegible] and islands, range of wing dams and control of brush and tree growth in the floodway between the levees.
7. Checking effects of the Baraboo River regarding interplay on areas of consideration.
8. Checking effects of the Fox River regarding interplay of separate river basins in the area of consideration.
9. Check the hydraulics of the Fox River Valley and the impacts of Wisconsin River overflows into that valley.
10. Specific evaluation of the operation of the Prairie du Sac dam spillways within the constraints of the Public Service Commission.
11. Evaluate and recommend operation procedures of the Castle Rock and Petenwell Dams and reservoirs within the constraints of the Public Service Commission.

12. Evaluation of alternatives:
   a) Levee placement, construction and maintenance:
      1) Total Protection of all property.
      2) Lesser degree of protection which will minimize damage to property downstream.
      3) Consider control structures to bypass [illegible] flows.

   b) Consideration of available soils for levee construction and maintenance.

   c) Funding the project.

   d) [illegible] within the [illegible] through the Township of [illegible] in Sauk County, the Township of Newport in Columbia County and downstream to [illegible], and determine how to handle excess flows above that amount.

13. It is specifically requested that the Corps of Engineers report to this committee after each procedural step for review and comments.

It was agreed that a copy of the minutes should be sent to all members of the committee and 10 days will be allowed for comments.

On a formal motion by Murphy, seconded by Bailey, any member shall contact Chairman Vik if the recommendations as printed require additions or corrections. This motion passed.

It was agreed that correspondence from the Corps of Engineers or from DNR should be circulated to all members of the committee as they are received by the Chairman. No specific time was set for the next meeting of this committee but it was left to the discretion of the Chairman to call a meeting when it appears necessary.

This concluded the business of the Wisconsin River Flood Control Citizens Committee.

Adjourned 11:17 a.m.

P. S. A telephone call was received from Radio Station [illegible] on the following day requesting that they be advised of the times and dates of future meetings and they requested permission to attend such meetings. The Chairman agreed to notify them and advised that all meetings would be open and they were welcome to attend.

Respectfully submitted,

Frederick A. Hoerter, P. E.
Secretary

FAH:bc

May 24, 1977
Additions to the Minutes:

A. The study shall not necessarily be confined to the points set forth in these minutes if more favorable results are anticipated from additional steps.

B. Marcus Gumz name was inadvertantly omitted from the list of Members.

C. The Chairman has removed Robert Irwin from an advisory status and appointed him as a regular Committee Member.

Harold O. Vik

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S. Earl
Secretary

BOX 450
MADISON, WISCONSIN 53701

March 22, 1977

IN REPLY REFER TO: 3550-1
FP-City of Portage

Colonel Forrest T. Gay III
District Engineer, Corps of Engineers
1135 U. S. Custom House
St. Paul, MN 55101

Dear Colonel Gay:

This letter is in response to your request of November 15, 1976. We were unable to meet the December 31, 1976 deadline due to an inability to locate some of the data requested. We hope the delay will not cause you a great deal of inconvenience. The following is the information you requested:

A. A list of all available information that our office can provide pertaining to the study area (Columbia County, Wisconsin, particularly the City of Portage and the Towns of Lewiston, Caledonia and Pacific).

   1. Our correspondence file on the Portage levee system.

   2. Our correspondence file on the city and county flood plain ordinances.

   3. The hearing record for the Columbia generating station in the Town of Pacific.

   4. The land ownership and the land use data in and around Portage.

   5. The levee system plan and profile sheet.

   6. The levee system benchmark data.

   7. A computer analysis of the 100-year flow (95,000 cfs) confined to the levee from the I-90-94 bridge upstream to Highway 33.

B. A listing of the general and specific problems we consider important in this investigation with an indication of the relative importance of each.

1. There is a real and general lack of confidence in the administrative discharge of 95,000 cfs at Portage. Analysis that uses past gage data does not reflect the effect of storage from the large flowages on the river.

2. If interbasin flow occurs or is allowed to occur, an assessment of the costs and benefits is necessary for all alternatives.

3. There is a portion of the City of Portage subject to flooding on the west bank of the Wisconsin River that must be considered in your studies.

4. There are no specifics as to what is hydraulic floodway and what is not. This must be defined by the study.

C. A listing of alternative solutions we believe should be evaluated to alleviate these problems while meeting the need for flood control.

1. Recalculate the basin hydrology.

2. Analyze the many combinations of flood flows including:

   a. Confining the Wisconsin River flows between the levees.
   b. Allowing interbasin flow to the Fox River.
   c. Overtopping or breaching of levees and the resultant flooding effects downstream and behind the levees.

3. a. Levee protection measures for the right bank of the Wisconsin River.

   b. Levee protection measures for the left bank of the river, north and south of Portage.

   c. Relocation of the structures in the city on the right bank of the river.

   d. Fee title purchase of flooded lands.

4. A delineation of the hydraulic floodways of the Wisconsin River and those rivers, streams and drainageways that may transfer flood flows away from the Wisconsin River.

D. A description of those studies considered necessary to assess the problems and alternative solutions.

1. a. Reconstruct gaging station records and evaluate the effects of upstream dams on past records. Separate snowmelt and rainfall events and analyze gaging records separately, then combine the frequency curves. Apply the new 100-year frequency discharge to the existing river conditions.

b. Hydrologically model the basin to determine the 100-year discharge at Portage under existing conditions and apply this to the hydraulic analysis.

2. All hydrologic and hydraulic studies necessary to address the flood effects of interbasin flow possibilities.

3. All hydrologic and hydraulic studies necessary to develop protection for all of the City of Portage.

4. All hydrologic and hydraulic studies necessary for the determination of hydraulic floodway lines of all alternative flow routes associated with the levee project.

This letter explains the problems and alternatives as we now see them. Because of unknown factors about the stated problems, it is impossible at this time to give all of the detailed alternatives and studies. We will be available as the study progresses to provide further detailed input on specific alternatives.

Sincerely,
Bureau of Water Regulation & Zoning

Floyd E. Stautz, P.E.
Director

cc: Robert Behrens - SD, Madison
Larry A. Larson
Terry L. Hampton

State of Wisconsin \ DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
4802 Sheboygan Ave.
P.O. Box 1487
Madison, WI 53701

April 26, 1977

Colonel Forrest T. Gay III
District Engineer
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

RE: NCSED-PB
Draft Plan of Study
Wisconsin River at Portage, Wisconsin
Feasibility Study for Flood Control

We have reviewed the above noted document and wish to offer the following comments:

1. Page 24 indicates that the 9-1/2 miles of levees on the south bank of the Wisconsin River (the Caledonia levee) prevents flooding of I 90-94, a vital transportation link in the region, and the State of Wisconsin. Pages 31 & 32 offer different alternatives for flood protection among them "alternative b" which "would degrade portions of the Caledonia levee to allow flood storage in the wetlands behind the levee." We strongly urge that study efforts of this alternative in particular recognize the considerable public investment I 90-94 represents to the region and Wisconsin and that flood control measures in Portage do not result in jeopardizing this vital transportation corridor during future floods.

2. We are also concerned that the degradation of the south bank levees may also result in potentially adverse effects to Portage residents and businesses and State Trunk Highways 78 and 33. We suggest that subsequent studies take into consideration the residents, businesses, and transportation corridors that may be adversely affected by this alternative.

We thank you for the opportunity to comment on this Draft Plan of Study.

Sincerely,

H. L. Fiedler, P.E.
State Highway Engineer

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
LWR

APR 1977

Colonel [illegible] T. Gay, III
District Engineer
U. S. Army Corps of Engineers
St. Paul
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

This refers to your letter of November 16, 1976 (your reference NCSED-PB) regarding your feasibility study of flood control in the Portage, Columbia County, Wisconsin, area.

In response to your question, we are interested in participating in your study. Please coordinate with Mr. Richard A. Hoppe, Supervisor of our Green Bay Field Office (GBFO), Telephone No. 414/465-2682.

The GBFO has available some fish and wildlife resource information on the Fox and Wisconsin Rivers and other waters within the Towns of Lewiston, Caledonia and Pacific. Our GBFO can help in gathering further information as your study progresses. Some of their current information is presented in this letter.

The Fish and Wildlife Service, in cooperation with the U. S. Soil Conservation Service, has performed a wetland survey for a number of south-central Wisconsin counties. We would be pleased to make available our wetland information for Sauk and Columbia Counties.

A very good sport fishery for a number of game fish, including walleye and muskellunge, exists in and near the study area. We hope that your study will present the sport fish resources impacted by the project and will develop appropriate methods to protect or enhance them.

At least 252 species of birds have been authoritatively recorded for Columbia County and some of Columbia County's best bird habitat is near Portage. The Wisconsin River floodplain immediately west of Portage has been characterized as some of the best floodplain woods along the entire Wisconsin River. The red-shouldered hawk is presently on the Wisconsin Department of Natural Resources' (DNR) "threatened" list. This species requires floodplain woods for nest habitat and loss of nesting habitat is suspected as the main reason for its con-

tinuing decline in Wisconsin. This area should also be good habitat for the barred owl and wood duck. Both species nest in wooded floodplains. Bald eagles make some winter use of the study area segment of the Wisconsin River. Peregrine falcons previously nested at Perry Mound, near Lake Wisconsin, and may possibly be reintroduced into the watershed.

The Swan Lake section of the Fox River contains an excellent mix of marsh, prairie, woods, and open water. In addition to being excellent habitat for a number of common wildlife species, the area provides breeding habitat for the less common Henslow's, grasshopper, savannah and lark sparrows. Harriers (marsh hawks) are on the DNR's "watch" list and they may breed here or elsewhere in the study area.

Within a distance of 10 miles, there are three DNR Public Hunting Areas, one between Swan Lake and Portage, the other two west of Portage along the Wisconsin River. Other public lands could also be impacted by permanent changes in water level or by changes in amplitude, duration, and frequency of flooding.

Dr. George Archibald of the International Crane Foundation indicates that the area west of Portage, immediately north of the Wisconsin River, contains some of Wisconsin's most productive sandhill crane habitat. This includes the area across the Wisconsin River north of the Leopold Memorial Reserve (to be discussed later).

It is apparent that the study area includes important game and non-game wildlife habitat. As with fish resources, we hope that your study will obtain all available information on the game and non-game wildlife of the area and that it will develop appropriate methods to protect or enhance them.

At present, we have no specific information on the botanical features of the area. However, since the area contains high quality and important fish and wildlife habitat, it is reasonable to expect a rich and productive flora. Your study should look closely at wetlands, including marshes and mature floodplain woods, and should determine the presence of endangered or protected plants. It is unknown if any such plant species are present. William Tans, Bureau of Research, Wisconsin Department of Natural Resources, Madison, might be helpful in this regard.

In addition to the above features, there is the very important parcel of land known as the Leopold Memorial Reserve. It is composed of approximately 1200 more-or-less contiguous acres along the Wisconsin River in Sauk County, Fairfield Township, T13N R7E and Government Islands 8 and 9 in the Wisconsin River, Columbia County. It was here --

in and around the still-standing log cabin he built -- that the late Aldo Leopold wrote some of his famous works. He also wrote about this very site and the immediate area. Aldo Leopold is often called the "Father of Wildlife Management", and is considered a great naturalist, writer, and educator. He is well known and his memory revered throughout the world. Your study should note carefully any action that might impact the Leopold Memorial Reserve. The Reserve is underwritten by the L. R. Head Foundation, 201 Waubesa Street, Madison, Wisconsin 53704, Telephone No. 608/221-0404, Mr. Reed Coleman, President. We suggest that Mr. Coleman be kept informed of the status of the study and any project that may be considered.

Solutions to the flooding problem and environmental protection problem might include:

1. Floodplain Evacuation - The cost of evacuation might be acceptable and high quality floodplain habitat would not be destroyed.

2. Floodplain Zoning - With proper local understanding and support, it is possible that parts of the floodplain can be developed while providing for preservation of fish and wildlife.

3. Diking - This solution may have merit, especially if an area of good habitat between the dike and river is preserved.

4. Dams - These structures can either benefit fish and wildlife or destroy them. Very close multi-agency coordination would be required to determine whether or not a dam or dams would serve all public interests in the study area.

It is our general concern that flood protection for the undeveloped floodplain would facilitate and encourage habitat destruction by human development of the former floodplain.

We appreciate this opportunity to communicate our views to you and we look forward to working with you to perform your feasibility study.

Sincerely yours,

William F. Martin
Assistant Regional Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
LWR

MAY 05 1977

Colonel Forrest T. Gay, III
District Engineer
U. S. Army Engineer District
St. Paul
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 35101

Dear Colonel Gay:

This responds to your letter of March 15, 1977, NCSED-PB, requesting our review and comment on the draft plan of study for the feasibility study of flood problems at Portage, Columbia County, Wisconsin.

In general, the draft plan of study (POS), appears to adequately encompass our areas of responsibility. At present we have no additional specific investigations to suggest, alternatives that should be investigated, nor comments or suggestions to improve the POS.

Our letter of April 1 discussed our areas of concern. To briefly recapitulate, they were: (1) Preservation or enhancement of the sport fishery within the project area; (2) Protection of the floodplain habitats and their valuable wildlife; (3) Consideration of Wisconsin Department of Natural Resources lands and other public lands that might be impacted; (4) Protection of endangered, or threatened plants and animals and their habitats; (5) Consideration of the Aldo Leopold Memorial Reserve.

We hope that the study area will not be limited to the Townships of Lewistown, Caledonia, Pacific, Fort Winnebago, and the City of Portage. If impacts of the project appear likely to extend beyond these townships, we would appreciate your help in investigating them as far as they may extend.

Our agency, through our Green Bay Field Office, will contribute to your study by providing biological information about the study area, providing impact evaluations of various project measures or alterations that may be developed, helping your staff develop measures to eliminate or minimize environmentally adverse project impacts, and developing any mitigation or compensation that may be required.

Sincerely yours,

Raymond L. St. Ores

Raymond L. St. Ores
Acting Assistant Regional Director

cc: U.S. EPA, Chicago, IL
WI DNR, Madison, WI
L. R. Head Foundation, 201 Waubesa Street, Madison, WI

the head foundation

201 Waubesa Street • Madison, Wisconsin 53704 • 608 244-3511

May 2, 1977

Mr. J. R. Calton
Chief, Planning Branch
Engineering Division
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Mr. Calton:

Thank you for your letter and copy of the draft for the Plan of Study for the Wisconsin River at Portage.

Although the Leopold Memorial Reserve is not specifically within the study area, it should certainly be listed as being in the locality in the section on Cultural Resources found on page 19.

Also, even though we are not in the study area, the impact of what this study eventually recommends will be felt on the Reserve, I am sure. We assume from your comments that you have seen the letter from Mr. Martin of the U.S. Fish and Wildlife Service. However, if you did not receive it, or do not have the letter at hand, we have enclosed a copy, as it provides some good background on what the Reserve is.

The Reserve area and the Leopold property has been the subject of natural study since the early 1930's. Our greatest concern is that the eco-systems in that area continue to be subject to the gradual natural process of change and do not become subject to traumatic change resulting from a flood control program.

We hope you will keep us informed.

If we can be helpful let us know.

Sincerely,

Reed Coleman, President
The Head Foundation

RC/tak
Enc.

Comments:

April 4, 1977

The Wisconsin Valley Improvement Company offers the following perspective regarding alternatives 5 & 6 on page 5 of the Feasibility Study outline for Portage, Wisconsin.

There is no possibility to provide flood storage at any of the hydro-electric dams upstream from Portage because of the following:

1. Urban and reacreational development is to extensive to permit any surcharge above present maximum pool levels.
2. Operating the pools at lower levels than now practiced would sacrifice hydro-power head and in some cases dewater intakes, sewers, landings and beach facilities.
3. Most of the hydro-plant pools are of insignificant size to provide helpful storage even if possible.
4. The exception of Spring drawdown of DuBay, Petenwell and Castle Rock is only possible when the snow pack is sufficient to assure timely refill.

Upstream reservoirs now existing are upstream from the flood-producing portion of the Portage drainage area. The one exception - the Big Eau Pleine reservoir - has insufficient capacity to store a significant volume of floodwater during any but the Spring snowmelt season. Enlargement of this is impractical if not impossible due to development of the shorelands.

At present, Spring flood peaks are routinely generously reduced by storage in Big Eau Pleine, DuBay, Petenwell and Castle Rock.

IMPORTANT!!! Would you like to be on the mailing list for this study?

Yes [X] No [ ]

Name Wisconsin Valley Improvement Company

Address 501 Jefferson Street, P.O. Box 988

City Wausau State Wisconsin

Zip 54401

Comments may be written above.

NCCPD-RL (NCSED-PB 16 Mar 77) 1st Ind
SUBJECT: Draft Plan of Study, Feasibility Study for Flood Control, Wisconsin River at Portage, Wisconsin

DA, Corps of Engineers, Chicago District, 219 S. Dearborn St., Chicago, Illinois 60604 25 APR 1977

TO: District Engineer, St. Paul

1. The subject POS is a well written document using a style that is generally easily understood and easy to read. The Section on the "Study Area" was particularly informative and interesting. We believe additional graphics would improve the Section on "Flood Problems and Alternative Solutions." While the Section on "Work Items, Scheduling and Costs" lists many tasks it fails to clearly identify who is responsible for each task and its scheduled completion date. The text explains the purpose of each major task but it does not highlight the interrelationships between some tasks nor does it always identify the sub-tasks within a major activity. Figure 40, the Study Schedule, presents a fine overview of the major study milestones and, as such, is suitable for slide presentations, etc. However, the figure lacks the necessary detail to either manage the study or clearly depict the study tasks and their interrelationships.

2. Our responses to the five items raised in the basic letter are provided below:

a. We have no additional investigations to recommend. We note the POS does not clearly identify what data is available and that data which will have to be acquired.

b. We have no additional alternatives to recommend, although we believe "no action" should be included in the listing.

c. Impacts on the flow regime of the Fox River should be addressed.

d. We may have data on the Fox River which would be useful. We need to know your needs.

e. We have no other comments or suggestions.

4. We appreciate the opportunity to comment on the subject draft POS. If you need additional information, you may contact Mr. Carl Hessel on 353-7515. We would appreciate being kept informed of study activities since the study may have impacts on the Fox River.

Andrew C. Remson, Jr.
ANDREW C. REMSON, JR.
Colonel, Corps of Engineers
District Engineer

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
4601 Hammersley Road, Madison, Wisconsin 53711

April 11, 1977

Colonel Forrest T. Gay, III
Department of the Army
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

We have reviewed the attached "Wisconsin River at Portage, Wisconsin, Feasibility Study for Flood Control" as you requested. The Soil Conservation Service is in the process of completing a Cooperative River Basin study on the same drainage basin. This study generated land use data and standardized hydrologic information which should be of value to the U.S. Corps of Engineers. If more specific information on the nature of this data is desired, please feel free to contact Robert W. Martin, Assistant State Conservationist for Water Resources, telephone number 608 - 252-5341 (FTS - 364-5341).

It is hoped that we can be of assistance.

Sincerely,

J.C. Hytry
State Conservationist

Attachment

United States Department of the Interior

NATIONAL PARK SERVICE
MIDWEST REGION
1709 JACKSON STREET
OMAHA, NEBRASKA 68102

IN REPLY REFER TO:
L7423 MWR DCL

Colonel Forrest T. Gay, III
District Engineer
St. Paul District, Corps of Engineers
1135 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

This replies to your March 15, 1977, letter transmitting a copy of your draft Feasibility Study for Flood Control, Wisconsin River at Portage, Wisconsin, and asking for our comments by April 30, 1977.

Where Federal funds are being expended, as you know, consideration must be given to historic, cultural, and archeological resources as mandated by the Historic Preservation Act of 1966 and Executive Order 11593. We note that the National Register of Historic Places lists five historic sites or properties in Columbia County that might bear on the study. One site, Fox-Wisconsin Portage Site, very likely will affect the feasibility study but all should be considered. Archeological sites that are known to be located within the study area or archeological sites that might be unknown but discovered as the results of future activities should be considered also. In Baraboo, Sauk County, three properties are listed, one of which is a National Historic Landmark. As Baraboo is within the study area, these also should be considered during the study.

We suggest that for archeological matters you consult with the State Archeologist, Dr. Joan Freeman, Wisconsin Archeological Survey, State Historical Society of Wisconsin, 816 State Street, Madison, Wisconsin 53706. For historical matters, including National Register properties, we suggest you consult the Wisconsin State Historic Preservation Officer, Mr. Richard A. Erney, at the same address.

We appreciate the opportunity to comment on this plan of study.

Sincerely yours,

Merrill D. Beal

Merrill D. Beal
Regional Director

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

APR 4 1977

Colonel Forrest T. Gay III
District Engineer
St. Paul District Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Thank you for the opportunity to comment on the Draft Plan of Study for the Feasibility Study of Flood Problems at Portage, Wisconsin.

The study area is within the statewide water quality management planning area and, therefore, should be closely coordinated with the Wisconsin Department of Natural Resources studies. Additionally, the proposed study of the effects of Wisconsin River flooding on the Fox River could affect planning being conducted by the Fox Valley Water Quality Planning Agency. If it is determined that proposals generated by your investigations may impact water quality in the Fox River, that portion of the study should be coordinated with the responsible Agency.

We have no objections to the Corps conducting the study as proposed. Your Environmental Protection Agency contact is Michael W. MacMullen, Chief, Water Quality Management Planning Section, FTS 353-2165. Due to limited resources and the national emphasis given to 208 planning, our participation in this study will be limited to review and comment or response to specific requests for assistance.

Sincerely,

George R. Alexander, Jr.
Regional Administrator

United States Department of the Interior

BUREAU OF MINES

4800 FORBES AVENUE

PITTSBURGH, PENNSYLVANIA 15213

April 4, 1977

Colonel Forest T. Gay, III
St. Paul District, Corps of Engineers
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Gay:

Re: Review of Draft Plan of Feasibility Study for Flood Control at Portage, Wisconsin

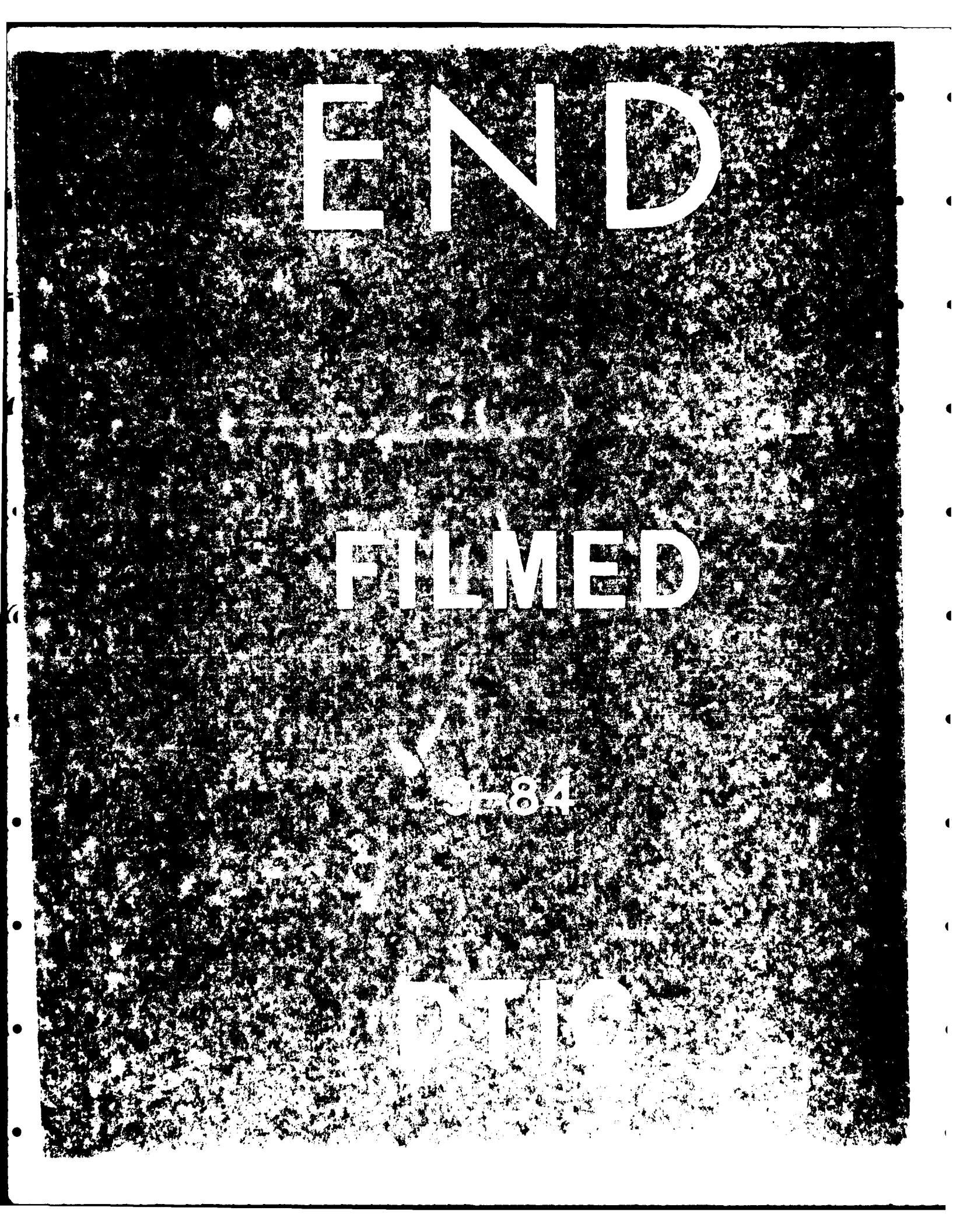
The purpose of this plan of study (a response to local resquests) is to develop effective and acceptable alternative flood control plans for the Portage, Wisconsin area due to the current potential for flooding because of area topography and past modifications to the Wisconsin River. We have reviewed the subject feasibility study with respect to our agency's area of interest -- mineral resources and mining.

We suggest that any major structural measures proposed during the planning phase should require onsite investigations as to possible mineral values which may be preempted.

Sincerely yours,

Robert D Thomson

Robert D. Thomson, Chief
Eastern Field Operations Center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